AND HEALTH CONCERNS OF CANADIAN WOMEN

A Background Paper

Canada

Occupational Safety and Health Concerns of Canadian Women

A Background Paper

Prepared by Karen Messing
for the Women's Bureau,
Labour Canada

Published by authority of the Minister of Labour,
Government of Canada

The opinions expressed in this publication do not necessarily reflect the views or policies of Labour Canada

Également disponible en français sous le titre : La santé et la sécurité des travailleuses canadiennes

Additional copies may be obtained from:

Publications Distribution Centre
Labour Canada
Ottawa, Ontario
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(819)994-0543

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Labour Canada Catalogue Number: L016-1748/91E
Printed in Canada

FOREWORD

Occupational Safety and Health Concerns of Canadian Women is based on research and a literature review undertaken by Karen Messing, Ph.D., Director of the Centre pour l'étude des interactions biologiques entre la santé et l'environnement (CINBIOSE) at the University of Quebec in Montreal. The literature review was completed in March 1989.

The Women's Bureau of Labour Canada appreciates the contribution of Freda Paltiel and the staff of the Office of the Senior Advisor on the Status of Women at Health and Welfare Canada in the development of this research project.

92-04291/

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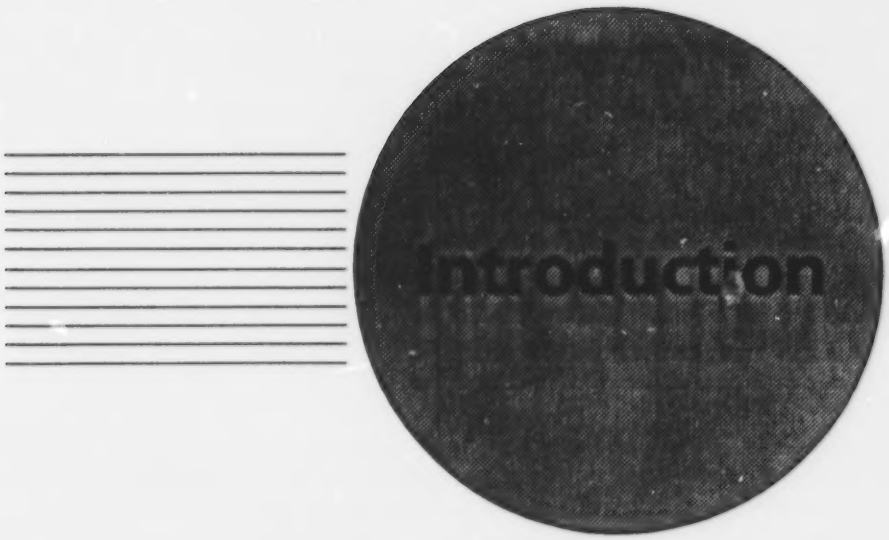

Introduction

The increased participation of women in the work force has resulted in growing attention to the occupational safety and health (OSH) risks faced by women. Legislators, researchers and the public have become aware of these issues as a result of lawsuits, research requests from groups such as unions, and publicity concerning, for example, video display terminal (VDT) exposure and protective reassignment for pregnant workers in Quebec. Despite this attention, OSH research in North America, including Canada, has moved slowly to address the hazards faced specifically by women or in occupations where the majority of workers are women.

This background paper will examine the possible health and safety issues associated with those occupations with a large number of women, so-called traditional female jobs, and will also examine selected health and safety concerns associated with non-traditional, blue-collar jobs. Although little research is available, some of the OSH concerns of aboriginal women, immigrant and visible minority women, and women with disabilities are highlighted where appropriate throughout the paper. Unless otherwise specified, the discussion is restricted to paid work, although unpaid work done by women also may involve health and safety risks. A conscious effort has been made to highlight Canadian studies.

The paper first presents an overview of women's OSH issues to explain why it is necessary to examine *women's* occupational health specifically. This first section includes the most recent census information about occupations held by the majority of Canadian women and provides a general description of some of the economic difficulties, family responsibilities, and biological variables which can interact with paid work to have an effect on women's health and safety. Potential safety and health issues for women entering occupations where tasks and equipment have been designed for average-sized men are introduced. The end of the section addresses the question of whether work in and of itself constitutes a hazard to women's health.

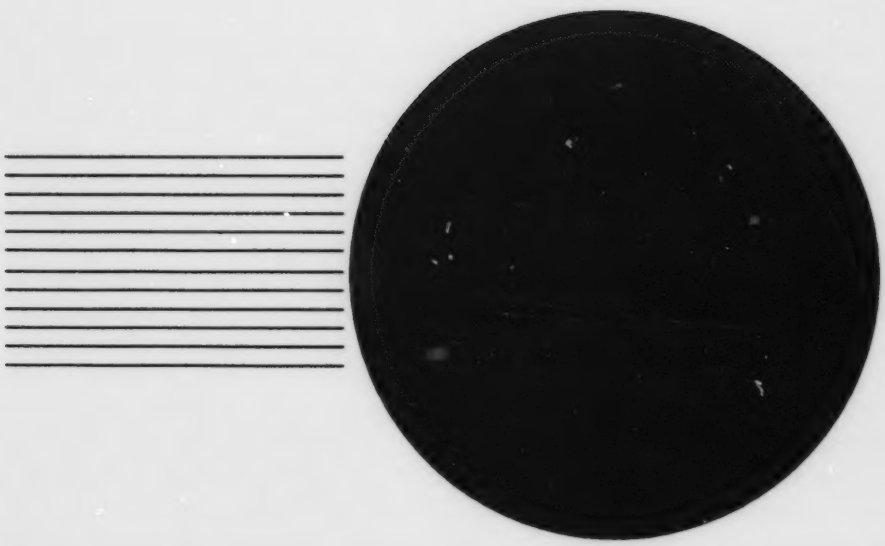
Section 2 is a general introduction to the occupational health field; it explains some of the methodological challenges involved in identifying occupational health risks for women, whether the effects produced be physical or psychological. The section examines interactions of workplace conditions with such variables as age, heredity, lifestyle and socio-economic status and their effects on health.

In Section 3 the focus is on health effects of the working conditions common to many jobs traditionally carried out by women, including such conditions as high-speed work and repetitive hand movements.

Section 4 presents some of the health effects associated with specific jobs (e.g., office worker, waitress) in order that each job be considered holistically. Working quickly in an office, for example, does not have all the same effects as working quickly in a poultry slaughterhouse. To achieve the different purpose of each of these two sections some repetition has been unavoidable.

Section 5 discusses health and safety issues for women entering non-traditional, blue-collar jobs. Biological differences between women and men are not sufficient to make certain jobs unsafe specifically for women. If appropriate adjustments are made for differences in size, weight and body type, all workers can benefit.

The Summary, Section 6, suggests that there are important gaps in information concerning women's occupational safety and health that would benefit from research.



A study on occupational cancers in the lead industry excluded the 950 women workers in order to keep the sample uniform.[1] A study on the health effects of unemployment-induced stress examined heart disease and mortality among unemployed men and their wives, but not unemployed women.[2] A study of the causes of premature births did not include any occupational variables.[3] In short, research into occupational health has tended to exclude women and research into women's health has tended to exclude occupational variables.

In addition, a recent study of major periodicals showed that medical scientists over-generalized from research on men, did not identify variables of importance to women's health and neglected women's health issues.[4] In the occupational safety and health field this bias translates into a lack of information on problems specific to, or most commonly encountered in occupations which are traditionally occupied by women. There has been relatively little OSH research into the conditions of work of, for example, waitresses and sales clerks. The facts that, on average, women tend to be economically disadvantaged compared with men and that they often combine domestic or family responsibilities with their paid work have also been insufficiently studied from a health perspective. As well, there has been little research into the effects of occupational hazards on the physiology of pregnant, menstruating or lactating women. Finally, relatively little is known about occupational safety and health risks for women entering non-traditional jobs where health and safety equipment as well as work methods have been designed for men.

Such ignorance may be a danger to women's health.

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1. W.C. Cooper, "Cancer mortality patterns in the lead industry," Annals of the *New York Academy of Science*, 271, 1976, pp. 2250-2259.
2. K.A. Moser, A.J. Fox, P.O. Goldlatt, and D.R. Jones, "Stress and heart disease: Evidence of associations between unemployment and heart disease from the OPCS Longitudinal Study," *Postgraduate Medical Journal*, 62, 1986, pp. 787-789.
3. G.S. Berkowitz, "An epidemiologic study of preterm delivery," *American Journal of Epidemiology*, 113, 1981, pp. 31-92.
4. M. Eichler, A.L. Reisman and E. Borins, "Sexism in medical research," *Canadian Science*, January 19, 1989.

Where do women work?

In any discussion of occupational safety and health issues most commonly encountered in occupations which are traditionally female, it is useful to review some of the general information concerning women's employment.

Canadian women are concentrated in a small number of jobs. According to the 1986 census (Table 1), more than four out of five women in the Canadian labour force were concentrated in only 10 of the 21 major occupational groups listed in the 1971 Standard Occupational Classification.[5] Furthermore, in 1986, four of the major occupational groups alone - clerical, services, sales, and medicine and health - accounted for approximately 65 percent of the female labour force. In contrast, men were distributed more evenly across all the groups, and the largest occupational groups for men - services, sales, construction and product fabricating - represented less than half the male labour force.[6] The fact that men and women hold different types of jobs, now as in the past, means that existing occupational safety and health research, based on studies of occupations held by men, has limited relevance for the majority of working women. Few, if any, studies have specifically examined the health effects of jobs done by waitresses, child care workers, cleaners, sales clerks, receptionists or teachers - over a million Canadian workers.[7]

In order to discuss safety and health of women workers, it is useful to identify the occupations, within the major groups mentioned above, where most women work. The 20 occupations which accounted for the greatest number of women in the labour force in 1986 are presented in Table 2. In the analysis of these various occupations in Section 4, the category of assembly line worker is added since data is available from Finland[8] and France showing that women are concentrated in routine

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5. Statistics Canada, *Dimensions, Occupational Trends, 1961-1986*, Ottawa, Supply and Services, 1988, (catalogue 93-151).

6. *Ibid.*

7. Some reasons for this underestimation are presented in K. Messing (in press), "Why it's not obvious to scientists that women have hard jobs." *Women and Health.*

8. K. Kauppinen-Toropainen, I. Kandolin and E. Haavio-Manila, "Sex segregation of work in Finland and the quality of women's work," *Journal of Organizational Behaviour*, 9, 1988, pp. 15-27.

assembly line jobs in those countries. The study from France demonstrated that a woman factory worker was several times more likely than a man to work on an assembly line.[9] This category does not appear in Table 2 because assembly line workers cross occupational categories.

In OSH research on female occupations it is often necessary to know more than the occupational title of a worker since, within some occupations, women are further segregated into specific tasks. For example, in the Quebec Ministry of Social Affairs, where 73 percent of workers in 1979 were women, an analysis[10] showed that men and women had separate job titles and separate responsibilities at all levels; the job category "stores" (care of hospital pharmacies and chemical supplies) was 85 percent male but, within it, 80 percent of store clerks (light work) were female, and 86 percent of storekeepers were men. In fish processing plants in Quebec[11] and Nova Scotia,[12] women and men worked in different parts of the production process.

One approach to studying occupational safety and health issues of concern to women is to study some aspects common to many women's occupations. Most of the jobs listed in Table 1 share a number of characteristics when they are done by women. They tend to be low-paid, low-prestige, subordinate positions.[13]

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9. D. Kergoat, *Les ouvrières*, Le Sycomore, Paris, 1982, pp. 42-43.

10. D. Gaucher, *L'égalité : Une lutte à finir*, Master's Thesis, Department of Sociology and Health, University of Montreal, 1979.

11. K. Messing and J.P. Reveret, "Are women in female jobs for their health? A study of working conditions and health effects in the fish-processing industry in Quebec," *International Journal of Health Services*, 13, 1983, pp. 635-643.

12. C. Lamson, "On the line: Women and fish plant jobs in Atlantic Canada," *Relations industrielles*, 41, 1986, pp. 145-157.

13. P. Armstrong and H. Armstrong, *The Double Ghetto*, revised edition, McClelland and Stewart, Toronto, 1984, pp. 49-51.

They are also characterized by working conditions which may have specific health effects. The physical characteristics of what would commonly be referred to as "women's jobs" tend to be distinctive.[14, 15] Many women work in constrained postures, sitting or standing without moving. They may work at a very fast pace, without many chances to rest. Whether they be nurses, teachers, receptionists or waitresses, their jobs often involve responding to the needs of other people. Rapid small hand movements are characteristic of women's assembly line jobs, as well as of typing done in office jobs and of cashiers' work in supermarkets. The effects on health of common job characteristics are discussed in Section 3, while health effects of specific jobs are discussed in detail in Section 4.

Economic realities for Canadian working women

Workers' bodies interact with the workplace depending on their physical condition. The healthy young body may resist damage from workplace chemicals better than the unhealthy or older body. Conversely, the poorly nourished body may be less able to tolerate polluted air in an office tower. Personal health, financial security, and workplace conditions interact in complex ways. For example, poor health, whatever its source, can prevent an individual from working, or working to full capacity, and therefore lower her income. However, a too-low income can itself worsen health by diminishing access to adequate nutrition and housing and by increasing stress levels. A Canadian study demonstrated the possible effect of income level on health, finding a difference of seven years in life expectancy between individuals in the richest and poorest neighbourhoods.[16] Since sick leave may be unavailable or too costly for women with low incomes, they may be forced to neglect their own health needs. Similarly, women with low-paying, unstable jobs may not be able to afford holidays, and therefore exhaustion may aggravate any health problems.

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14. D. Mergler, rapport-synthèse, "Les conditions de travail des femmes," in J.-A. Bouchard (ed.), *Les effets des conditions de travail sur la santé des travailleuses*, Confédération des syndicats nationaux, Montréal, 1983, pp. 215-227.

15. J. Kaul and M. Lie, "When paths are vicious circles: How women's working conditions limit influence," *Economic and Industrial Democracy*, 3, 1982, pp. 465-481.

16. R. Wilkins and O.B. Adams, "Health expectancy in Canada, late 1970s: Demographic, regional and social dimensions," *American Journal of Public Health*, 73, 1983, pp. 1073-1080.

Today, as in the past, women tend to earn less money in the workplace than men. On average, in 1989, women employed full-time for the full year earned only 65.8 percent of the average earnings of their male counterparts.[17] Once it might have been thought that women's salary levels were irrelevant to their financial health or security, because women were supported by men. However statistics show that the divorce rate and the number of lone-parent families are increasing. In 1987, over 84 percent of all lone-parent families were headed by women, whose median income was $18,426, only 47.4 percent of the median income of all Canadian families.[18] Other groups of women, namely aboriginals (Canadian status and non-status Indians, Métis and Inuit), immigrants, members of visible minorities, and women with disabilities, are often the most poorly paid in Canada. It has been reported for example that 70 percent of employed disabled women earn less than $15,000 per year.[19]

In Canada women aged 25 to 45 have historically experienced higher rates of unemployment than men of this age. Periods of unemployment result in lower income, suggesting an indirect negative effect on health. In addition, unemployment, studied in men, has been shown to have negative effects on mental and physical health.[20]

Underemployment as well as unemployment may have serious health and economic consequences. In 1989, approximately one quarter of all employed women worked part-time, making up 72 percent of the part-time work force.[21] Part-time jobs are often less stable than full-time jobs and can lead to economic insecurity.[22] One study in Ontario

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17. Statistics Canada, *Earnings of Men and Women*, 1989, Catalogue 13-217, Annual.

18. *Ibid.* Table 16, p. 76 and Table 18, p. 77.

19. J. Ridington, *Different Therefore Unequal: Employment and Women with Disabilities*, DisAbled Women's Network Canada, Vancouver, B.C., 1989, p. 42.

20. Supra, Note 2.

21. Statistics Canada, *The Labour Force, December 1989*, (Catalogue 71-001), Table 10, p. c-19.

22. Statistics Canada, Labour and Household Surveys Analysis Division, "Canada's Women: A Profile of their 1986 Labour Market Experience," *Profiles*, May 1988, (Catalogue 71-205 Annual).

demonstrated that aboriginal women in particular tend to be over-represented in part-time, unstable, low-paying jobs.[23] They received lower incomes and had limited access to health, pension and other benefits.

Unionization tends to be associated with higher income. In 1986, almost 65 percent of women employed part-time or full-time, across all occupations, were *not* unionized. These women earned an average hourly wage of $8.67, less than three-quarters the average wage of unionized women.[24]

Work and family responsibilities

Physical fitness and therefore the ability to resist workplace hazards can also be affected by the addition of family responsibilities to the paid work day. A body tired out from taking care of a baby or ill parent may be less able to resist a virus at a hospital job or to protect itself against the solvents in cleaning solutions. Therefore, an understanding of women's occupational health requires an appreciation of one important component of most women's lives, the combination of paid work and family responsibilities.

Although this combination may have significant health effects, OSH research has not yet focused on the double work day. Statistics indicate, however, that more and more women with children are entering and remaining in the work force. In 1988, 58.4 percent of all mothers with children under the age of three were in the labour force.[25] Despite adjustments made by some families, in most families women still take care of most domestic work and family responsibilities.[26] The addition of responsibility for spouses, children or older relatives to paid work can

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23. P.J. Nicholson, *Economic Status of Native Women in Ontario*, Toronto, Ontario Women's Directorate, Government of Ontario, 1987, p. 22.

24. Statistics Canada, Special Surveys Division, *Survey of Union Membership, December 1986*, Unpublished data.

25. Statistics Canada, Household Surveys Division, *Labour Force Annual Averages 1981-1988, (1988 annual averages)*, Catalogue 71-529.

26. M. Kempeneers, "Questions sur les femmes et le travail: Une lecture de la crise," *Sociologie et sociétés*, 19, 1987, pp. 57-71.

add up to a total work week of 60 or even 100 hours.[27, 28] In some occupations such as farming and industrial home sewing where children may be present at the worksite, women may be required to divide their concentration between child care and the task at hand, thus increasing the risk of accidents for both themselves and their children. Detriment to health may also result if women use their own sick leave allowances to care for other family members and are thus unable to care for themselves adequately when they are sick or injured.

What about biological differences?

There are very few ways in which women's bodies differ radically from those of men in their reaction to the workplace. For example, there is no chemical, biological or physical condition which is a risk for most or all women workers which does not also pose some risk for men workers (and vice versa). Workplace conditions can affect three biological functions specific to women (pregnancy, menstruation and lactation) and, therefore, research on women's OSH must take them into consideration. Following is a very brief summary of known OSH issues surrounding pregnancy, menstruation and breast feeding.

To date most research on pregnancy and the workplace has concentrated on foetal effects; for example, an exhaustive listing of research on pregnant workers compiled for physicians discussed chemical and radiation effects only on the foetus and mentioned only a few studies of the effects of working conditions on the pregnant woman herself.[29] Some of the known potential health effects for pregnant women are: intensification of bacterial or viral disease; increased fatigue from vibration, lifting weights or high temperatures; increased back pain from uncomfortable positions; and increased varicose veins from standing for long periods.[30]

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27. C. Le Bourdais, P.J. Hamel and P. Bernard, "Le travail et l'ouvrage. Charge et partage des tâches domestiques chez les couples québécois," *Sociologie et sociétés*, 19, 1987, pp. 37-55.

28. D. Tierney, P. Romito and K. Messing, "And she ate not the bread of idleness : Exhaustion is related to domestic and salaried working conditions among Quebec hospital workers," *Women and Health*, 1990, 16, pp. 21-42.

29. Health and Welfare Canada (undated), *The Pregnant Worker: A Resource Document for Health Professionals*. Ottawa, 167 pp.

30. *Ibid.*

N. Cherry, "Physical demands of work and health complaints among women working late in pregnancy," *Ergonomics*, 1987, 30, pp. 689-701.

Despite a scarcity of *occupational* health research, much is known about changes to the mother's body during pregnancy. She must furnish food and air and regulate body temperature, as well as process and eliminate waste for the developing foetus. Pregnant women tend to be at greater risk from exposure to pollutants in the workplace because they take in more air and thus more toxins. Also, their liver, kidneys and other detoxifying systems are already heavily burdened by the requirements of the foetus and may have trouble dealing with additional pollutants. Conditions which put strain on the heart, such as stress or a hot environment, may be riskier for the pregnant woman, since her heart is working harder already. Although their biology is such that women's bodies can adapt to pregnancy, as well as to a polluted atmosphere or to unpleasant working conditions, certain combinations of these factors may push an individual body beyond its capacity to adapt.

As mentioned, there have been more studies of the effects of the work environment on the foetus than on the mother.[31] Since it accompanies her into the workplace during pregnancy, the foetus breathes the same air, is exposed to the same temperature stresses, and to some extent hears the same noise as does the pregnant woman.[32] In general, research into the effects of chemical agents and radiation on the foetus has advanced much further than any research into the effects of more prevalent working conditions for women such as repetitive work or uncomfortable positions.

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31. J.E. Lockey, G.K. Lemasters and W.R. Keye, (eds.), *Reproduction: The New Frontier in Occupational and Environmental Health Research*, Alan R. Liss, New York, 1984.

32. N.M. Chenier, *Reproductive Hazards at Work*, Canadian Advisory Council on the Status of Women, Cat. No. LW31-30/1982E, Ottawa, 1982, 104 pp. This is a review of the major issues involved in protecting the foetus against workplace aggressors.

    K. Hemminki, O. Axelson, M.-L. Niemi and G. Ahlborg, "Assessment of methods and results of reproductive occupational epidemiology," *American Journal of Industrial Medicine*, 4, 1983, pp. 293-307.

    L. Goulet and G. Thériault, "Association between spontaneous abortion and ergonomic factors," *Scandinavian Journal of Work, Environment and Health*, 13, 1987, pp. 399-403.

The work environment can also affect fertility of both male and female workers, and one study associated infertility with several working conditions.[33] Very little information is available on the exact factors which diminish fertility, either directly by affecting the health of eggs and sperm or indirectly by diminishing sexual desire or performance.

Some studies have shown that workplace characteristics such as cold,[34] exposure to solvents,[35] or lifting weights at a fast pace[36] can produce menstrual pain (dysmenorrhea) and that women exposed to hormones in pharmaceutical plants may be at increased risk of menstrual disorders.[37] Since, as yet, very little is known about what causes menstrual pain, more research into the working conditions which tend to exacerbate dysmenorrhea could be useful to many working women. Better information would facilitate the identification of factors in the work environment which could be changed to improve workers' health. For example, knowledge that cold working conditions can affect general health and can specifically exacerbate menstrual cramps could suggest simple adjustments to working conditions.

Aside from the difficulties in reconciling nursing with work schedules,[38] the actual quality of the milk of nursing mothers can be affected by their working conditions. However, not enough research has been done on, for example, the effects of chemical exposures on the breast milk of working mothers.[39] In general, fat-soluble materials can find their way into milk, often in higher concentrations than in the workers' blood.

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33. P. Rachootin and J. Olsen, "The risk of infertility and delayed conception associated with exposures in the Danish workplace," *Journal of Occupational Medicine*, 25, 1983, pp. 394-402.

34. D. Mergler and N. Vézina, "Dysmenorrhea and cold exposure," *Journal of Reproductive Medicine*, 30, 1985, pp. 106-111.

35. O.N. Syrovadko, "Working conditions and the state of health of women working with organosilicon varnishes containing toluene," *Gig. Tr. Prof. Zabol.*, 12, 1977, pp. 15-19 (In Russian, abstract by NIOSH-00116012).

36. F. Tissot, K. Messing, J. Ferraris and N. Vézina, "Menstrual symptoms and working conditions among hospital workers," *Communication*, American Public Health Association, Boston, Massachusetts, November 1988.

37. H. Willems, "Occupational exposure to estrogens and screening for health effects," *Journal of Occupational Medicine*, 23, 1981, pp. 813-818.

38. J.M. Morse, J.L. Bottorff and J. Boman, "Patterns of breastfeeding and work: The Canadian experience," *Canadian Journal of Public Health*, 80, 1989, pp. 182-188.

39. M.S. Wolff, "Occupationally-derived chemicals in breast milk," *American Journal of Industrial Medicine*, 4, 1983, pp. 259-281.

Workers may be exposed to polychlorinated biphenyls (PCBs) which can be transmitted to the milk,[40] and pesticides[41] have also been found concentrated in breast milk. These chemicals have been found to increase risk of nervous and hormonal disorders or damage to the immune system.[42]

No published research has explored the relationship of working conditions other than chemical exposures to the ability to lactate successfully. Despite questions asked by many women, no studies were found, for example, to test whether stress and fatigue induced by working conditions could affect nursing mothers or the ability to nurse.

Women in non-traditional, blue-collar occupations

Research pertaining to the health and safety of women in non-traditional occupations is also quite limited. However, there have been some interesting studies (see Section 5) pertaining to task characteristics and design which may assist women (and many men) to protect their health in traditional male jobs.

Employment and Immigration Canada defines "non-traditional occupations" as those occupations where women represent fewer than one-third of workers. In 1985, there were 313 occupations which corresponded to this definition. Women were completely absent in one occupation and represented 15 to 33 percent of workers in 111 occupations.[43] Non-traditional jobs may range from construction worker to senior manager.

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40. S. Yoshida and A. Nakamura, "Residual status after parturition of methylsulfone metabolites of polychlorinated biphenyls in the breast milk of a former employee in a capacitor factory," *Bulletin of Environmental Contamination and Toxicology*, 21, 1979, pp. 111-115.

41. E.P. Savage, T.J. Keefe and J.D. Tessari, "Pesticides in human breast milk." In Hunt, V.R., Smith, M.K., Worth, D., *Environmental Factors in Human Growth and Development*, Banbury Report No. 11, Cold Spring Harbor Laboratory, Cold Spring Harbor, N.Y., 1982, pp. 77-84.

42. R.D. Kimbrough and A.A. Jensen (eds.), "Halogenated biphenyls, terphenyls, naphthalones, dibenzodioxins, and related products," *Topics in Environmental Health*, Volume 4, Elsevier, Amsterdam, 1989.

43. Unpublished data, 1986, Census of Canada, Technical Services, Employment Equity Branch, Employment and Immigration Canada, December 7, 1988.

The fact of working in a non-traditional occupation does not of itself raise new OSH issues. If the move is into a position of higher pay and status (for example senior management), it may have positive effects on health, although family life may be affected. Health risks may arise, however, from moving into an environment where physical tasks and equipment have been designed for the average man's body size and shape, such as is the case with many blue-collar or industrial jobs. It is beyond the scope of this paper to review all blue-collar occupations or trades, but Section 5 provides a general discussion of health and safety issues for women entering these occupations.

Health of homemakers versus women in paid employment

Comparisons of health status between homemakers and working women are the subject of much debate. Each group might be skewed towards poorer or better health by a multitude of variables. Unhealthy women might leave or never enter the work force, thus biasing the group of homemakers toward poorer health; conversely, working women might encounter various occupational health risks, thereby biasing them toward poorer health. Although it may be of limited usefulness to study such heterogeneous groups, research has not indicated that either group is necessarily healthier or unhealthier than the other. American studies have shown that, in general, working women have fewer mental and physical health problems than homemakers.[44, 45] The health of women working part-time has been shown to be better than that of homemakers and not as good as that of full-time workers.[46] The Framingham Heart Study, which followed Massachusetts women aged 45 or older for a period of nine years and included 350 homemakers and 387 women employed outside the home, found no differences between the two groups in terms of coronary heart disease, although it did associate heart disease with some specific working conditions.[47]

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44. Several studies are reviewed in: C. Nathanson, "Social roles and health status among women: The significance of employment," *Social Science and Medicine*, 14A, 1980, pp. 463-471.

45. T. Cox, M. Thirlaway and S. Cox, "Occupational Well-Being: Sex differences at work," *Ergonomics*, 27, 1984, pp. 499-510.

46. J. Herold and I. Waldron, "Part-time employment and women's health;" *Journal of Occupational Medicine*, 27, 1985, pp. 405-412.

47. S.G. Haynes and M. Feinlib, "Women, work and coronary heart disease," *American Journal of Public Health*, 70, 1980, pp. 133- 141.

Several researchers have compared the outcomes of pregnancies of working women and homemakers. Effective comparison is difficult because of the possibility of unhealthy workers leaving the workplace, and because full-time homemakers may have less access to prenatal care and counselling.[48] On the other hand, women whose pregnancies "succeed" in producing many children may also leave the workplace due to the difficulties of combining domestic and salaried responsibilities.[49] No consistent relation has been found between employment during pregnancy and problems such as low birth weight, prematurity or perinatal mortality.[50] This is not to deny that certain components of the work environment may pose a problem for pregnant women, as mentioned above.

Therefore, one cannot conclude that working outside the home is generally any more hazardous than working in the home. However, specific working conditions may affect women's health, and risks possibly associated with a particular occupation should be identified.

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48. P. Romito and F. Hovelaque, "Changing approaches in women's health: New insights and new pitfalls in prenatal preventive care," *International Journal of Health Services*, 17, 1987, pp. 241-258.

49. M. Joffe, "Biases in research on reproduction and women's work," *International Journal of Epidemiology*,14, 1985, pp. 118-123.

50. M.J. Saurel-Cubizolles and M. Kaminski, "Work in pregnancy: its evolving relationship with perinatal outcome (a review)," *Social Sciences and Medicine*, 22, 1986, pp. 431-442.

Table 1

Major Occupational Groups for Women in Canada, 1986

Major Occupational Group		Labour Force Total Women (000's)[52]	Percentage[51]
1.	Clerical and related	1,777	31
2.	Services	870	15
3.	Sales	544	10
4.	Medicine and health	472	8
5.	Teaching and related	326	6
6.	Managerial, administrative and related	324	6
7.	Product fabricating, assembling, and repairing	223	4
8.	Social sciences and related	139	2
9.	Farming, horticulture, and animal husbandry	127	2
10.	Processing	107	2
Total in major occupational groups		4,909	86%
Total in all occupations		5,653	100%

Source:
Dimensions, Occupational Trends, 1961-1986, Statistics Canada, November 1988, Catalogue 93-151.

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51. Based on rounded figures.
52. Rounded to the nearest thousand.

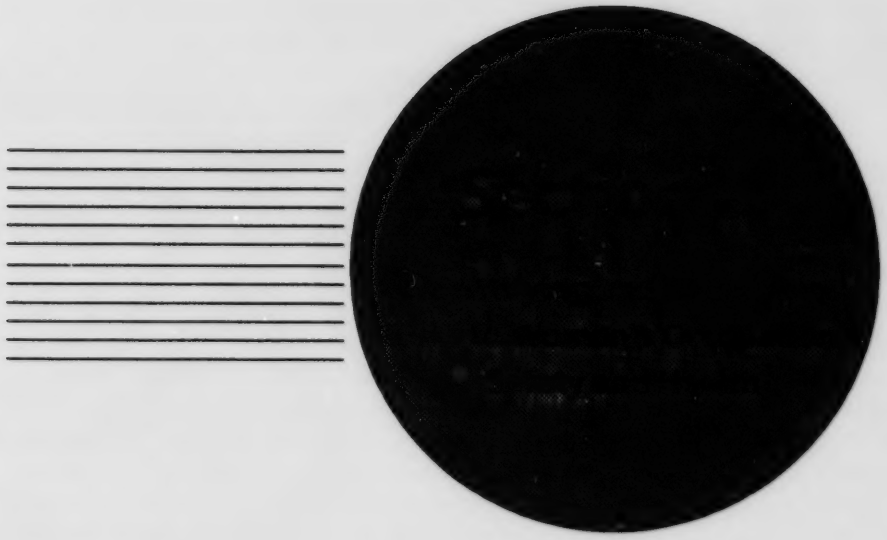
Table 2

Principal Occupations of Women in Canada, 1986

	Occupations - Women	Major Groups	Number (000's)[54]	%[53]
1.	Secretaries and stenographers	Clerical and related	425	7.5
2.	Salespersons, commodities	Sales occupations	330	5.8
3.	Bookkeepers and accounting clerks	Clerical and related	325	5.7
4.	Tellers and cashiers	Clerical and related	261	4.6
5.	Nurses, graduates except supervisors	Medicine and health	211	3.7
6.	Waiters, hostesses, stewards-food and beverage	Service	210	3.7
7.	Elementary, kindergarten teachers	Teaching and related	152	2.7
8.	General office clerks	Clerical and related	131	2.3
9.	Receptionists and information clerks	Clerical and related	107	1.9
10.	Janitors, charworkers, cleaners	Service	100	1.8
11.	Supervisors, sales occupations, commodities	Sales	97	1.7
12.	Chefs and cooks	Service	93	1.6
13.	Electronic data processing equipment operators	Clerical and related	89	1.6
14.	Farm workers	Farming, horticulturing and animal husbandry	84	1.5
15.	Child care workers	Service	75	1.3
16.	Accountants, auditors and other financial officers	Managerial, administrative and related	75	1.3
17.	Barbers, hairdressers	Service	71	1.2
18.	Sewing machine operators, textiles and similar materials	Product fabricating, assembling and repairing	68	1.2
19.	Nursing aides/orderlies	Medicine and health	64	1.1
20.	Secondary school teachers	Teaching and related	59	1.0
	Total in above occupations		3027	53.2
	Total in all occupations		5653	100.0%

53. Based on rounded figures.

54. Rounded to the nearest thousand.



Before examining health concerns for women workers and specific traditionally female occupations, it is useful to review some of the methods used to identify occupational health risks. It can be difficult to prove scientifically that a workplace or certain working conditions are hazardous to the worker's health. While it may often be suspected that the source of a given health problem is in the workplace, current research methods and measures may be unable to link the two conclusively. Therefore, this section discusses some of the issues that arise when there is an attempt to identify and measure risks to health and link them to the workplace. The section includes an examination of variables such as lifestyle, age and heredity which may interact with workplace conditions to affect health.

What does it mean to say that a risk is associated with a health effect? Some definitions

The dictionary defines "health" as "the condition of being sound in body, mind, or spirit ... especially freedom from physical disease or pain,"[55] and the World Health Organization defines it as "a state of complete physical, mental and social well-being ... not only to be free of illness, but also to have the possibility to develop and preserve one's functional capacities." A health effect can therefore be a *symptom* which causes discomfort such as tired eyes, reported often by office workers using visual display terminals;[56] it can also be an *illness*, such as the cancers which afflicted women who were exposed to asbestos fibres while assembling gas masks during World War II.[57] Illnesses include *reproductive effects* such as the doubled risk of miscarriage for women hospital workers who used ethylene oxide gas to sterilize equipment during their pregnancy.[58] Finally, health effects of work include *signs*, biological parameters which may cause no inconvenience or pain to the

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55. *Webster's Ninth Collegiate Dictionary*, Thomas Allen & Son Limited, Markham, Ontario, 1987.

56. L. Rose, "Workplace video display terminals and visual fatigue,". *Journal of Occupational Medicine*, 29, 1987, pp. 321-324.

57. B.J. Wignall and A.J. Fox, "Mortality of female gas mask assemblers," *British Journal of Industrial Medicine*, 39, 1982, pp. 34-38.

58. K. Hemminki, P. Mutanen, I. Saloniemi, M.-L. Niemi and H. Vainio, "Spontaneous abortions in hospital staff engaged in sterilising instruments with chemical agents," *British Medical Journal*, 285, 1982, pp. 1461-1463.

worker but can be revealed by routine examination or biological testing, such as the reported increased frequency of genetic changes to the blood cells of hospital technicians who worked with radioactivity.[59]

Women's and men's health and safety are affected by their work. Their jobs can expose them to a *risk*, that is, a statistical chance of having some health effect. Risks to workers' health can be of various types: physical, chemical, biological, ergonomic and psycho-social.

A *physical* risk arises from the physical environment; it may be visible, like a slippery spot on the floor, or completely invisible, like radiation. A *chemical* risk may originate from any of several sources, e.g., from solvents, furnace fumes or cigarette smoke. A *biological* risk from micro-organisms may come from experimental material used in laboratories, or from contact with humans or human cells carrying communicable diseases. *Ergonomic risks* are those from uncomfortable working positions or heavy physical tasks. *Psycho-social risks* can come from difficulties with supervisors or fellow workers, such as sexual harassment, but also from the perception of other types of risks.

Many workplace conditions have the potential to affect health. However, not all workers will be affected in the same way or to the same degree. Just as not all smokers die young, not all hospital workers catch diseases. Thus, making the association between a particular job and a symptom or illness can be complicated.

How can a health risk be related scientifically to a health effect?

Methodological problems arise when research is limited to defined illnesses rather than signs or symptoms, because disease is a relatively rare occurrence, and many diseases take a long time to develop. Even though the presence and severity of an illness can be objectively verified, it may be quite difficult to relate the illness to workplace causes. For example, it can be difficult to relate cancers to working conditions. Cancer can be induced by "carcinogens," usually chemicals or radiation, which cause an injury to a single cell in the body. The person who has undergone the carcinogenic event feels nothing and may present no symptoms for 20 years or more. During this time, the

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59. K. Messing, A.M. Seifert, J. Ferraris, J. Swarz and W.E.C Bradley, "Mutant frequency of radiotherapy technicians appears to be related to recent dose of ionizing radiation," *Health Physics*, 57, 1989, pp. 537-544.

individual may be exposed to agents or conditions which promote, or inhibit, the spread of cancer. But it is very difficult to relate the occasional cancer, which may manifest itself after the worker has retired, to conditions in the workplace 20 years before. A million-dollar Canadian study of occupational cancers gave this as a reason for excluding women, saying that, 20 years ago, too few women were exposed to carcinogens (or were employed in occupations where they would be likely to be exposed to carcinogens) for effects to be shown.[60] (This type of argument can, of course, be circular; that is, excluding women from such studies guarantees that no occupational cancers will be found among women, thus confirming the notion that women's jobs are safe.)

Problems relating exposures to effects also occur when studying reproductive hazards. Effects on a foetus are most serious during the first eight weeks of pregnancy when foetal organs are developing, but most women are not sure of their pregnancy before six weeks at the earliest. An early miscarriage may not be detected, and a malformation detected late in pregnancy or after birth may not be traced to workplace exposures in the first few weeks of pregnancy.

In fact, some of the methodological challenges inherent to OSH research are particularly well illustrated by the kinds of questions that have arisen concerning the effects of the workplace on pregnancy and reproduction. In the case of VDT exposure, there was concern about potential negative effects on pregnancy when four women at the *Toronto Star* who worked with VDTs gave birth to malformed children. Paradoxically, this example could not itself be used to confirm harmful effects of VDTs, but only to call attention to a possibility that there might be a problem. The occurrence at the *Toronto Star*, technically referred to as a cluster, did not confirm VDT risk because, in the absence of any special exposure to harmful conditions, there is one chance in 25 that *any* child will be born with a malformation. Similarly, there is a one in 10 chance that any pregnancy will miscarry after the woman becomes aware she is pregnant.[61] Therefore, among 5,000 workplaces

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60. J. Siemiatycki, M. Gerin, L. Richardson et al., "Preliminary report of an exposure-based case-control monitoring system for discovering occupational carcinogens," *Teratogenesis, Carcinogenesis and Mutagenesis*, 2, 1982, pp. 169-177.

61. A. D. Bloom, (ed.) *Guidelines for Studies of Human Populations Exposed to Mutagenic and Reproductive Hazards*, March of Dimes Birth Defects Foundation, White Plains, N.Y., p. 47. Table 1.

where 10 pregnant women work with VDTs, it can be calculated that in two of them, four women or more will give birth to malformed children, and in over 50 of them, four or more women will have miscarriages. Unless a specific risk factor can be identified, measured and related to the effect in a large number of workplaces which all share the same risk factor, it is not possible to prove that the workplace or working conditions are hazardous. The occurrence might have been a statistical accident.

The traditional methods in OSH research rely on the availability of a sufficiently large study group in order to obtain statistically significant results. Results are statistically significant if the researchers have less than one chance in 10 to be wrong if they assert that there is a problem. This can be very frustrating for the worried pregnant woman, who might prefer the burden of proof to be on the other side. For example, it is not easy to find large numbers of pregnant women exposed to similar working conditions at similar stages in their pregnancy, and this has limited the number of connections which can be made conclusively between working conditions and damage to the pregnant woman or the foetus.

An additional methodological issue in trying to relate workplace exposures to specific effects is that a given toxin can result in different kinds of illness, depending on the dosage.[62] For example, foetal damage may vary from miscarriage to neonatal death to malformation, depending on the dosage and time of exposure. The number of neonatal malformations which occur in a given workplace might not be statistically significant; however, if combined with the number of miscarriages and neonatal deaths, a statistically significant association might be found. Since it is hard to devise methods for examining all effects at once without very large sample sizes, some health effects may be missed.

Other measures of workplace health effects

Since illnesses are so difficult to associate with occupational hazards, scientists and doctors are often asked to examine health symptoms. Scientific problems arise from the fact that symptoms are so often

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62. S.G. Selevan and G.K. Lemasters, "The dose-response fallacy in human reproductive studies of toxic exposures," *Journal of Occupational Medicine*, 29, 1987, pp. 451-454.

detected first by the worker herself, and the most reliable, inexpensive and efficient measures are subjective. The science of conducting research on subjectively perceived symptoms is not yet well-developed.[63, 64] Concerns have been expressed that the worker with symptoms may, for example, over-report previous exposures to dangerous working conditions.[65]

This is one reason an increasing number of scientists like to study *signs* rather than illnesses or symptoms. Signs, as defined above, are biological parameters which can be readily obtained for large groups of workers, although they are not necessarily associated with illness or discomfort for the individual. Signs are not an all-or-none phenomenon but are part of a description of each worker. Although only a small number of workers will have heart attacks, they will all have a blood pressure reading and a number of genetic changes in their cells. This makes it possible to relate exposure to signs among an adequate group of workers with a specific set of working conditions, in order to demonstrate biological effects of work. For example, high diastolic blood pressure[66] was related to work in stressful situations in intensive care or emergency wards in hospitals.[67] Since the worker is not aware of her blood pressure, her reporting of working conditions should not be biased.

To deal with some of the complexities involved in using miscarriages and malformations as measures of reproductive risks, scientists have suggested studying signs such as birth weight. Birth weight is a sensitive indicator of the health of a newborn, and thus of events taking

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63. K. Messing, "Putting our two heads together: A mainly women's research group uses subjective perceptions to understand women's occupational health." In J. Wine, J. Ristock, (eds.), *Feminist Activisim in Canada: Bridging Academe and the Community*, James Lorimer Press, Toronto. 1990.

64. S. Reinharz, "Experiential analysis: a contribution to feminist research," In Bowles, G., Klein, R.D. *Theories of Women's Studies*, Routledge and Kegan-Paul, London, England, 1983, pp. 162-209.

65. S.G. MacKenzie and A. Lippman, "An investigation of report bias in a case-control study of pregnancy outcome," *American Journal of Epidemiology*, 129, 1989, pp. 65-75.

66. Diastolic blood pressure is the smaller of the two numbers usually used to describe blood pressure, e.g., the 80 in 120/80.

67. M.R. Van Ameringen, A. Arsenault and S.L. Dolan, "Intrinsic job stress and diastolic blood pressure among female hospital workers," *Journal of Occupational Medicine*, 30, 1988, pp. 93-97.

place during development, and constitutes information that is readily available for each child.[68] Measures of signs such as these cannot be considered as indicating good or poor health for an individual child, but data from many workers can be pooled and used as an indicator of possible health problems in a workplace.

A similar measure that has been suggested is time of conception, calculated from the time that a couple decides to have a child.[69] This is also information which is available for each pregnancy, and which may indicate subfertility. Subfertility and infertility may arise from damage to reproductive cells of male or female workers; such damage has been associated with exposure to several workplace conditions, including metals, noise, and dyes.[70] However, fertility may be affected by other, more subtle exposures, such as stressful conditions which may affect sexual desire or performance. The latter problems do not seem to have been studied from an occupational health perspective.

The disadvantage of signs is that since they are not illnesses, they are not usually compensable in law and may not be taken seriously as indicators that a health problem exists in the workplace. Being more global indicators, they may be contested as coming from other types of exposure, such as smoking or leisure time activities. Also, workers have expressed concerns that those identified by monitoring programs as showing signs of effects of their working conditions may be discriminated against by being denied access to certain jobs, being passed over for certain kinds of work or being dismissed as incapable of remaining in the job for health reasons.[71]

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68. J. Kline, B. Levin, Z. Stein et al., "Epidemiologic detection of low dose effects on the developing foetus," *Environmental Health Perspectives*, 42, 1981, pp. 119-126.

69. D.D. Baird, A.J. Wilcox and C.R. Weinberg, "Use of time to pregnancy to study environmental exposures," *American Journal of Epidemiology*, 124, 1986, pp. 470-480.

70. *Supra*, Note 33.

71. G.R.C. Atherley, "Medical monitoring versus human rights, "*International Journal of Health Services*, 13, 1983, pp. 265-275.

Determining exposure in the workplace

To relate an exposure to an effect, the exposure must be known. The perfect method would be to measure every kind of exposure for every workplace. This is unfortunately not possible for the large numbers of workers who need to be studied in order to obtain statistically significant results.

Various methods have been found for classifying exposures in the workplace. Some studies simply use job title as a surrogate for exposure. For example, incidence of miscarriage may be associated with work in certain industries. However, a recent study of the "sick building syndrome" showed that the association between job title and various symptoms disappeared when working conditions were examined closely; it was the working conditions which were associated with the symptoms.[72] Similarly, a recent study of genetic damage in the nuclear industry showed that use of job title actually concealed evidence of radiation effects, which became clear when measurements of real exposure were taken.[73] Thus, job title may not be a good way to estimate exposures.

Other studies use knowledge of industrial hygiene to attribute a common exposure, be it chemical[74] or ergonomic,[75] to diverse occupations. Sometimes, health effects can be clearly ascribed to specific, single causes which can be suspected, and the suspicion confirmed in this way. Mesothelioma is a specific and unusual type of lung cancer usually caused by exposure to asbestos; angiosarcoma is a liver cancer usually caused by exposure to vinyl chloride monomer. A study which identifies asbestos or vinyl chloride exposure might pick up cases of mesothelioma or angiosarcoma and relate them to these substances.

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72. P. Skov, O. Valbjorn and B.V. Pederson, "Influence of personal characteristics, job-related factors and psychosocial factors on the sick building syndrome," *Scandinavian Journal of Work, Environment and Health*, 15, 1989, pp. 286-295.

73. K. Messing, A. M. Seifert and J. Lemaire, "In vivo mutant frequency of factory workers exposed to very low doses of ionizing radiation," *Environmental Metagenesis*, 15 (suppl. 11), 1990, p. 41.

74. J.C. McDonald, J. Lavoie, R. Cote and A.D. McDonald, "Chemical exposure at work in early pregnancy and congenital defects: a case-referent study," *British Journal of Industrial Medicine*, 44, 1987, pp. 527-533.

75. N. Cherry, "Physical demands of work and health complaints among women working late in pregnancy," *Ergonomics*, 1987, 30, pp. 689-701.

But more often, workplaces have more than one pollutant. In addition, the body reacts globally, that is, as a result of complex interactions between internal and external stimuli. The effect of lifting weights, for example, may be very different if the workplace is hot.[76] Isolating one working condition without considering others may lead to errors. For example, some studies on VDTs and pregnancy which considered only the number of hours worked with no attention paid to the actual conditions of VDT use may have yielded misleading results (see also the discussion of VDTs in section 4). It is therefore difficult to relate working conditions to specific illnesses, symptoms, or signs, unless there is a single, overwhelming toxic agent with a well-defined, relatively rare health effect.

Applications of statistical techniques, perhaps taken from ecological analysis, to give a global portrait of exposures and effects, have not yet been well developed.

Measuring effects of the workplace on mental health

Tasks contain both mental and physical components, which can affect mental health as well as physical. The same problems experienced in measuring physiological effects of work recur with even more force in measuring mental health exposures and effects. "Objective" tools to measure anxiety, depression, tension, or other mental health parameters are difficult to devise, although considerable work has been done on this problem.[77] Semi-objective parameters such as the reported number of tranquilizers taken or number of psychiatric visits measure more than mental health; they also reflect socio-economic status and an orientation towards seeking medical advice for life's problems. Some researchers, such as Frankenhaeuser, have measured levels of certain metabolites associated with a stress reaction.[78]

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76. C. Brabant, S. Bédard and D. Mergler, "Cardiac strain among women laundry workers engaged in sedentary repetitive work," *Ergonomics*, 32, 1989, pp. 615-628.

77. I. McDowell, *Measuring Health: A Guide to Rating Scales and Questionnaires*, Oxford University Press, 1987.

78. M. Frankenhaeuser, "Quality of life: Criteria for behavioral adjustment," *International Journal of Psychology*, 12, 1977, pp. 99-110.

Similar difficulties occur when measuring those task parameters which probably contribute to mental health problems: autonomy, repetition, work speed, and relations with co-workers, clients and employers. For example, a fast pace of work is an important component of women's working environment (see Section 3), but how can the speed of cutting up chickens be put on the same scale as that of taking X-rays or taking care of children in a day care centre? Workers at all three jobs may feel rushed, but their subjective feelings are one of the few ways to compare them.

Such qualitative analyses are being done in France, where scientists are developing a discipline known as work psychopathology, which applies psychoanalytic concepts to study the ways workers seek to maximize pleasure and minimize pain at their jobs.[79] Different techniques used by women and men to obtain pleasure at work have been described.[80] A similar kind of description of factory work was published in the United States, although the concepts were not named in the same way.[81]

Other variables which affect reactions to the workplace

Even in those instances where a known occupational risk factor is identifiable and measurable, its effects may be mediated (diminished or heightened) by behavioural, physiological or psychological factors. For example, asbestos produces more cancers in smokers than in non-smokers; older workers report more back pain associated with lifting; due to individual differences, a situation which stresses one worker may not stress another.

A lot is known about the effects of some of these variables (such as smoking, age and alcohol consumption) on personal health. In fact, because they are easier to study, much more is known about them than about the effect of workplace conditions on health. In a population of some 13 million Canadian workers, only a few thousand work in any given profession, and even fewer share the same working conditions.

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79. C. Dejours, *Psychopathologie du travail*, Entreprise Moderne d'Édition, Paris, 1985. 214 pp.

80. H. Hirata and D. Kergoat, "Rapports sociaux de sexe et psychopathologie du travail." In *Plaisir et souffrance dans le travail*. Vol 2. (Ed. C. Dejours). Centre national de la recherche scientifique. Paris. 1988. pp. 131-176.

81. B. Garson, *All the Livelong Day: the Meaning and Demeaning of Routine Work*, Penguin Books, Markham, Ontario. 1975. 220 pp.

But it is estimated that there are some four million workers who smoke,[82] more than three million workers over 45,[83] and over 700,000 who admit drinking more than three alcoholic drinks per day.[84] Workers' ages and smoking behaviour, and to some extent alcohol consumption, can often be readily ascertained.

On the other hand, it is difficult to find out about occupational exposures; workers don't necessarily know their exposures, and it is difficult, expensive, and often unreliable to go into the workplace and measure them. It is impossible to measure exposures which have taken place in the past. It is much easier to obtain statistically significant results relating lung cancer to personal smoking than to exposure to second-hand smoke as a waitress in a bar with poor ventilation.

Access to an adequate group of subjects has also influenced the kind of research that has been done on work and pregnancy. If findings are extrapolated from a Quebec study[85] to the Canadian population, among six million women workers, approximately two million have been pregnant within the past fifteen years, and it is estimated that 300,000 will be pregnant in any given year. Continuing this extrapolation, almost one-half of pregnant women are over 30, and about one in four smokes. On the other hand, only about one in 20 lifts weights with some regularity.

To study the effects on the foetus of lifting weights during pregnancy, it is necessary to find out who lifts weights and how often, whether twisting is involved, how heavy the weights are, and in what trimester the lifting is done. Then, it may be necessary to control for extraneous variables which might bias the results, such as age and health of the subjects. Even then, weights may be squirming animals or children, or they might be inert boxes, which may have quite different effects on the

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82. Extrapolated from Health and Welfare Canada, *Canada's Health Promotion Survey: Technical Report*, I. Rootman et al. (eds.), Ottawa, Supply and Services Canada, 1988, p. 20.

83. Statistics Canada, Census 1986, *Summary totals: Labour force, mobility and education*, Table LF86B01, March, 1988.

84. *Op. cit.*, Health and Welfare Canada, p. 46, Table 8.

85. C. Martin, *L'activité professionnelle de la femme enceinte*, Commission de la santé et de la sécurité du travail du Québec, 1980.

musculo-skeletal system. Given the size of the total population (pregnant women who lift weights) and all the variables which need to be controlled to obtain meaningful results, it is not surprising that little is yet known about the effects of lifting on pregnancy.

In general, research on the effects of age, smoking, chemical agents and radiation on pregnancy has advanced much further than research on more common conditions such as repetitive work or muscle strain. (Methodological problems are only part of the reason for this delay; there is also reluctance to incur economic consequences by identifying very common conditions as risky.)

Habits like smoking and alcohol consumption can affect resistance to workplace toxins; their heredity may make some people more sensitive than others to the same conditions; and the normal process of aging affects reactions to some working conditions. But knowledge of the effects of such mediating variables, some of which are outlined below, does not diminish the need to examine in detail the effects of working conditions. In fact, as the brief discussions below indicate, the working conditions themselves can affect the prevalence of these mediating variables. A study of 87,000 Swedish workers concluded that "job factors are the next strongest set of predictors of health and (health-related) behaviour after age."[86]

Smoking

Smoke contains a variety of toxins, including chemicals and radioactive materials which can change genes and respiratory poisons and metal particles which can affect the nervous system. Smoking increases the likelihood of getting not only cancers of many types but also heart disease, kidney disease, and many other diseases.[87] It also acts as what is called a co-carcinogen in increasing the likelihood that other

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86. R. Karasek, B. Gardell, and J. Lidell, "Work and non-work correlates of illness and behaviour in male and female Swedish white collar workers," *Journal of Occupational Behaviour*, 8, 1987, pp. 187-207.

87. M.H. Mushinski and S.D. Stellman, "Impact of new smoking trends on women's occupational health," *Preventive Medicine*, 7, 1978, pp. 349-365.

workplace poisons will cause cancer. It affects the likelihood that women will have miscarriages, stillbirths, and underweight babies and lowers the vitamin content of mothers' milk. Smoke accumulates in poorly ventilated work spaces and affects other workers.[88]

Studies show that poor working conditions and low income are associated with increased likelihood of smoking, although this is a clearer trend in men than in women.[89] Waitresses, for example, have a high statistical probability of smoking. A nurse who does administrative work is more likely to smoke than a nurse in intensive care.[90] A female domestic worker is much less likely to quit smoking than a female lawyer. Paradoxically, workers exposed to hazardous conditions which may cause cancer are more likely to smoke, probably because people in lower socio-economic categories are more likely both to smoke and to be exposed to hazards.

Therefore studies have suggested not only that smoking can be linked to workplace-induced illnesses but also that the workplace and low pay can be linked to smoking behaviour.

Aging

As people get older, a series of normal physiological changes take place. Joints become less supple, blood vessels tend to block, and muscles tend to weaken. As well, genetic damage accumulates in the body's cells.[91] Pregnancies of older women are more likely to end unsuccessfully, and children born to older mothers have a greater probability of malformations.

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88. P. Price, *Passive Smoking: Health Effects and Workplace Resolutions*, Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, February, 1989, P89-2E, pp. 5-8.

89. S.D. Stellman, P. Boffetta and L. Garfinkel, "Smoking habits of 800,000 American men and women in relation to their occupations," *American Journal of Industrial Medicine*, 13, 1988, pp. 43-58.

90. K. Dore and J. Hoey, "Smoking practices: Knowledge and attitudes regarding smoking by university hospital nurses," *Canadian Journal of Public Health*, 79, 1988, pp. 170-173.

91. A.A. Morley, "Mutation frequency in human lymphocytes increases with age," *Mechanisms of Ageing and Development*, 19, 1984, pp. 325-331.

Women's aging process is somewhat different from men's. Women live longer than men, but spend much more time incapacitated.[92] For example, women are less likely to die of heart attacks but more likely to have arthritis.

As women and men age, they lose their capacity to recover from workplace injuries. In Quebec in 1988, the proportion of work accidents which led to permanent incapacity increased from 3 percent at age 15 to 19, to 12 percent in the over-65 age group.[93]

Workers may need to change jobs as they grow older. In an extreme case, reported by ergonomists in France, young women glovemakers were "superannuated" at 26! The job was so taxing that only the youngest and fittest could do it.[94] The same research group has reported segregation by age; in several studies, the youngest worked where the pace of work was fastest.[95] The age structure of women's top 20 jobs is shown in Table 3.

However, it is more difficult to examine the effects of age on reactions to work, because the work itself may contribute to the aging process. A Finnish study showed that workers lost their ability to do certain physical tasks more rapidly if their jobs were physically demanding.[96] In France, aging women in public service jobs had more heart and lung problems if they had worked at taxing jobs.[97]

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92. L. Roy, *Des victoires sur la mort*, Conseil des affaires sociales et de la famille, Quebec, 1983, pp. 3-5.

    S. Dillard, *Durée ou qualité de vie*, Conseil des affaires sociales et de la famille, Quebec, 1982.

93. M. Gervais, *Profil statistique des lésions avec incapacités permanentes*, rapport, Institut de recherche en santé et en sécurité du travail du Québec, 1988.

94. C. Teiger, "Les contraintes du travail dans les travaux répétitifs de masse et leurs conséquences sur les travailleuses." In Bouchard, J.-A. (ed.), *Les effets des conditions de travail sur la santé des travailleuses*, Confédération des syndicats nationaux, Montréal, 1984, pp. 33-68.

95. F. Desriaux and C. Teiger, "L'âge, facteur de sélection au poste de travail," *Gérontologie et société*, 45, 1988, pp. 33-45.

96. J. Ilmarinen, "Physiological criteria for retirement age," *Scandinavian Journal of Work, Environment and Health*, 14 (supp.1), 1988, pp. 88-89.

97. F. Derrienic and Y. Iwatsubo, "Santé après la retraite en relation avec le passé professionnel," *Gérontologie et société*, 45, 1988, pp. 56-70.

Table 3

Age Structure of Women's Occupations, Canada, 1986

Occupations		Major Groups	Median Age
1.	Secretaries and stenographers	Clerical and related	33.8
2.	Salespersons, commodities	Sales occupations	31.0
3.	Bookkeepers and accounting clerks	Clerical and related	32.4
4.	Tellers and cashiers	Clerical and related	25.8
5.	Nurses, graduates except supervisors	Medicine and health	34.6
6.	Waiters, hostesses, stewards-food and beverage	Service	23.4
7.	Elementary and kindergarten teachers	Teaching and related	37.9
8.	General office clerks	Clerical and related	33.4
9.	Receptionists and information clerks	Clerical and related	31.6
10.	Janitors, charworkers, cleaners	Service	40.6
11.	Supervisors, sales occupations, commodities	Sales	32.5
12.	Chefs and cooks	Service	35.0
13.	Electronic data-processing equipment operators	Clerical and related	30.8
14.	Farm workers	Farming, horticulturing and animal husbandry	--98
15.	Child care workers	Service	29.6
16.	Accountants, auditors and other financial officers	Managerial, administrative and related	34.1
17.	Barbers, hairdressers	Service	28.4
18.	Sewing machine operators, textile and similar materials	Product fabricating, assembling and repairing	38.9
19.	Nursing aides and orderlies	Medicine and health	37.0
20.	Secondary school teachers	Teaching and related	38.7

Source: Statistics Canada, Census 1986. *Population and Dwelling Characteristics, Occupation*, The Nation, Ottawa, March 1989.

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98. Data not available.

Heredity

It has been hypothesized that differences in heredity (genes) may predispose workers to some diseases. For example, it was once thought that workers whose cells produced large quantities of a chemical called serum anti-trypsin had inborn hypersensitivity to lung disease and should not be hired to work in foundries where they would be exposed to fumes. Some employers even tested workers for sensitivity at the point of hiring.

But to date, there have been no clear links between any hereditary factor and hypersensitivity to the workplace. In the case just mentioned, it turned out that it was the foundry fumes which induced changes in the lungs, which in turn changed the levels of the serum anti-trypsin. So it was exposed workers, not "sensitive" workers, who were more likely to have lung disease, and therefore to appear sensitive on tests.[99]

Heredity is sometimes invoked in discussions of the effects of some environmental agents on people of different races. However, races differ not only in heredity, but also often in economic and social conditions. Thus, when studying the occupational health and safety of members of different races, all pertinent variables including heredity, economic and social factors should be carefully considered.

Socio-economic status

A recent report prepared as part of Canada's Health Promotion Survey[100] reviewed some of the literature which shows the link between actual and perceived health and socio-economic status (SES). The relation between socio-economic status and health is especially relevant to women workers, since they have low average earnings and their jobs tend to have low prestige. Lower socio-economic and occupational status have been shown by many studies to be strong predictors of morbidity and mortality.

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99. D. Tierney and K. Messing, "New tricks for old dogs," *Alternatives: Perspectives on Society, Technology and Environment*, 14(3/4), 1987, pp. 31-36.

100. P.D. Rosenbaum and J. Bursten, "Canada's Health Promotion Survey: Technical Report Series," *Special Study on Labour Force Groups*, December 1988, Health Promotion Directorate, Health and Welfare Canada.

It is difficult to separate the effects of socio-economic status from the effects of working conditions or, in the case of some groups, from the effects of discrimination against certain races or against disabled people. For example, it is often not appropriate to control for SES when studying the effects of work or of specific working conditions, since the type of work is an important determinant of socio-economic status, and the same job title may have a different content when done by a person of lower SES. In fact, many health effects attributed to low SES may in fact be due to poor work conditions.[101]

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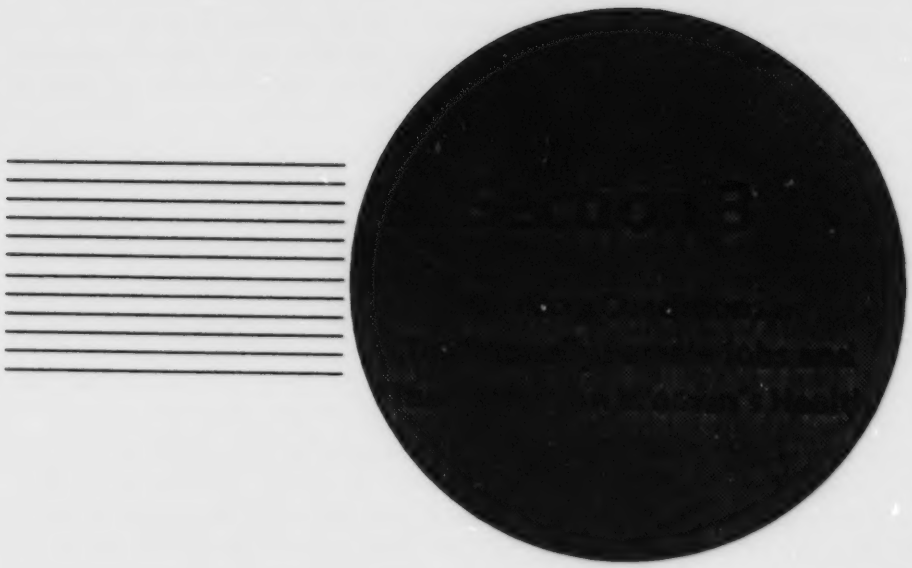
101. C. Brisson, D. Loomis and N. Pearce, "Is social class standardisation appropriate in occupational studies?" *Journal of Epidemiology and Community Health*, 41, 1987, pp. 290-294.



Many working conditions can pose a risk to working women and men. Researchers have identified several such factors: prolonged exposure to loud noise may damage hearing; exposure to asbestos causes several types of lung disease; exposure to high concentrations of solvents causes damage to the nervous system. In this section, the effects of factors associated with the kinds of jobs held by a large number of women are discussed. The fact that they are discussed here does not mean that they are *specific* to women's jobs or to women's biology, only that they are *common* to many women's jobs. In fact, in one study, men in typical women's working conditions reported the same health symptoms as women in these conditions.[102]

Many conditions in women's (and men's) jobs elicit the stress reaction, so it will be discussed before effects of individual working conditions are examined. This is not because women are more likely to experience stress, but because several working conditions characteristic of women's jobs produce a stress reaction in men and women.

Stress[103]

Effects of the work environment may be perceptible as physical or psychological; the body does not always distinguish between the two. It can be particularly difficult to analyze the effects of women's working conditions when talking about "stress." Workers often talk about how stressful their jobs are, and this usually refers to feelings of nervousness or anxiety that are connected with their work, induced by emotional pressures from clients, colleagues or superiors. These feelings can be very acute, and the suffering involved deserves attention. People often distinguish between "real" physical suffering and mental suffering. So it is important to understand *that the body does not distinguish between stress originating from mental and physical causes*, or the two together. Technically, there is a *stress reaction* which can be induced by many types of *stressors*, physical, mental and emotional.

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102. D. Mergler, C. Brabant, N. Vézina and K. Messing, "The weaker sex? Men in women's working conditions report similar health symptoms," *Journal of Occupational Medicine*, 29, 1987, pp. 417-421.

103. D. Mergler, Personal Communication. See also G.S. Lowe, *Women, paid/unpaid work, and stress: New directions for research*, Canadian Advisory Council on the Status of Women, Ottawa, Document 89-S-155., 1989, 74 pp.

The stress reaction has been built into the body during evolution so people are able to save themselves from dangerous situations. When it comes into contact with anything that menaces its integrity, the body mobilizes for running away or fighting. This "fight or flight" reaction lowers the level of housekeeping functions which maintain the body and raises the level of whatever makes it resist the stressor. For example, muscles tense and digestion slows. The heart beats more strongly to send blood to feed the muscles, and breathing is more rapid in order to supply the muscles with air. This "stress reaction" can be provoked by many workplace conditions, from noise to chemicals to sexual harassment.

When the danger is acute, people recognize their pounding heart, tension, and "butterflies in the stomach" as part of a stress reaction. But what happens when the same stressors are so much part of the everyday environment that they are no longer surprising or noticed? The long-term effects of exposure to agents that can initiate the stress reaction are just starting to be studied. As would be expected, since so many physiological systems are involved, there is no unique illness that is associated with the stress reaction, but rather there are many symptoms and diseases. For example, in fish-processing plants, employees with a fast pace of work feel more tired and anxious and have more insomnia and digestive problems than those who class their pace as moderate.[104] Women in office work with non-supportive supervisors are more likely to have heart disease, especially if they have several children.[105] A large study in France compared working conditions of mothers of premature babies with working conditions of mothers of full-term babies and found that premature births were associated with conditions producing "mental stress": few rest periods, constant demands, inability to talk with co-workers and repetitive work.[106, 107]

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104. *Supra*, Note 11.

105. S.G. Haynes and M. Feinlib, "Women, work and coronary heart disease," *American Journal of Public Health*, 70, 1980, pp. 133-141.

106. N. Mamelle, B. Laumon and P. Lazar, "Prematurity and occupational activity during pregnancy," *American Journal of Epidemiology*, 119, 1984, pp. 309-322.

107. N. Mamelle, F. Munoz, D. Collin, F. Charvet and P. Lazar, "Quantification de la charge de travail féminin pendant la grossesse," *Archives des maladies professionnelles*, 42, 1984, pp. 205-210.

The body is able to adapt to the presence of aggressors in the workplace, within certain limits. For example, women's bodies adapt over time to work at high temperatures.[108] But the stress reaction puts further pressure on the body's capacity to defend itself against many kinds of workplace aggressors. Thus, stressful working conditions may be associated with a variety of symptoms and illnesses.

Since the stress reaction has a physiological base, researchers are beginning to develop techniques to measure the biological correlates of mental states. Karasek has developed a classification of jobs according to the degree of control workers have over their job parameters and the level of demands placed on them. Work in jobs with "high demand, low control" is associated with symptoms of coronary heart disease.[109] In addition, researchers have found a relationship between blood pressure and hospital work in life-threatening situations,[110] and between unemployment and the functioning of the immune system.[111]

In the discussion which follows, characteristics common to many women's jobs are outlined and associated with health effects. In addition to these specific health effects, all the conditions described can elicit the stress reaction. It should be noted that "doubly disadvantaged" aboriginal, immigrant or disabled women may suffer from additional stressors such as isolation, discrimination or difficulties in communication.

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108. J. Puchalska and S. Kozlowski, "The relationship between physiological stress and age in women working in hot environments," *Medycyna pracy*, 20, 1969, pp. 197-209, NIOSH-00019953.

109. R.A. Karasek, "Characteristics of task structure associated with physiological stress and cardiovascular illness," *Annals of the American Conference of Governmental Industrial Hygienists*, 8, 1984, pp. 27-32.

110. *Supra*, Note 67.

111. B. Arnetz, J. Wasserman, B. Petrini, et al., "Immune function in unemployed women," *Psychosomatic Medicine*, 49, 1987, pp. 3-12.

High-speed work

High-speed work is a common characteristic of women's jobs in factories and offices.[112, 113, 114] Women in poultry slaughterhouses cut up one chicken per second; sewing machine operators sew 225 pairs of pants an hour, typists may be controlled by their micro-computers, which scold them if they haven't "produced" a sufficient number of characters in a given time; information operators are warned by their supervisors if they do not process telephone calls quickly enough.

In the short term, time pressure can make people very uncomfortable. Assembly line workers under time pressure get more tired, and have more aches and pains, digestive problems, and insomnia.[115, 116] In Canada, women post office employees doing fast-paced, repetitive work under rigid supervision have reported more depression, more physical symptoms and worse mental health than other women workers.[117] In a study of data entry clerks, work speed was the major factor related to a variety of mental health symptoms.[118]

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112. D. Mergler, rapport-synthèse, "Les conditions de travail des femmes," In Bouchard, J.-A. (ed.), *Les effets des conditions de travail sur la santé des travailleuses*, Confédération des syndicats nationaux, Montréal, 1983, pp. 215-227.

113. K. Kauppinen-Toropainen, I. Kandolin and P. Mutanen, "Job dissatisfaction and work-related exhaustion in male and female work," *Journal of Occupational Behaviour*, 4, 1983, pp. 193-207.

114. *Supra*, Note 102.

115. *Supra*, Note 104.

116. *Supra*, Note 114.

117. H.C. Northcott and G.S. Lowe, "The influence of working conditions on psychological distress in the Post Office," *Canada's Mental Health*, September 1984, pp. 25-32.

118. A. Billette and J. Piché, "Health problems of data entry clerks and related job stressors," *Journal of Occupational Medicine*, 29, 1987, pp. 942-948.

Factory workers can work at piecework rates or be paid by the hour. Time pressure is greatest when the worker is paid for piecework. Piecework has been associated in various industries with a high rate of accidents.[119] Among sewing machine operators, piecework is associated with anxiety and depression,[120] and with taking medication for digestive problems.[121]

Fast-paced work under machine-controlled conditions or rigid supervision has been associated with collective stress reactions among telephone operators and others.[122] Such reactions were first dismissed as "hysteria,"[123] but have since been identified as a reaction to difficult working conditions.

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119. D. Berthelette, *La rémunération au rendement et la sécurité du travail: recherche-synthèse*, Institut de recherche en santé et en sécurité du travail du Québec, Rapport PS82-02, 1983, Montreal.

120. M. Vézina, A. Vinet and C. Brisson, *Vieillissement prématuré associé au travail répétitif sous contrainte de temps dans l'industrie du vêtement*, Proceedings of the Human Factors Association of Canada, 1987, pp. 263-265.

121. A. Vinet, M. Vézina, C. Brisson and P.M. Bernard, "Piecework, repetitive work and medicine use in the clothing industry," *Social Science in Medicine*, 28, 1989, pp. 1283-1288.

122. A. Yassi, J.L. Weeks, K. Samson and M.B. Raber, "Epidemic of "shocks" in telephone operators: lessons for the medical community," *Canadian Medical Association Journal*, 140, 1989, pp. 816-820.

B.A. Hollett, *Hazard Evaluation and Technical Assistance*. Report No TA 77-35, Bluewater Sea Foods Products, Cleveland Ohio. National Institute of Occupational Safety and Health, U.S. Department of Health Education and Welfare, Center for Disease Control, Cincinnati, Ohio. 1978.

National Institute of Occupational Safety and Health, *Health Hazard Evaluation Determination*, Report No HE 78-138-580, Tecumseh Product Co., Grafton, Wisconsin, National Institute of Occupational Safety and Health, U.S. Department of Health Education and Welfare, Center for Disease Control, Cincinnati, Ohio. 1979.

R.S. Kramkowski, *Hazard Evaluation and Technical Assistance*, Report No TA 78-10, BRK Electronics, Aurora, Illinois.National Institute of Occupational Safety and Health, U.S. Department of Health Education and Welfare, Center for Disease Control, Cincinnati, Ohio. 1979.

123. F. Sirois, "Epidemic hysteria," *Acta Psychiatrica Scandinavia*, (Supplement) 251, 1974, pp. 1-46.

A fast work pace can also act as an intensifier of other workplace hazards. For example, if women work quickly in taking X-rays, they will take more X-rays and run a higher risk of exposing themselves. A fast work pace may cause the worker to neglect important safety precautions, thus increasing the risk of accidents.

The effects of constant time pressure can make themselves felt over the long run. Coronary heart disease and hypertension were related to limited rest periods at work among aging Finnish municipal workers.[124] Piecework doubled the risk that a sewing machine operator would be permanently incapacitated with age due to musculo-skeletal and cardiovascular problems.[125]

Responding to the needs of others

Most of the traditionally female occupations shown in Table 1 require responding to the needs of clients, whether they be patients in hospitals, children in schools, or customers in supermarkets. Dealing with the public can be very rewarding, but also very demanding and difficult. The centre of control may pass from the worker to the other person, constituting the kind of "high-demand, low-control" job which is associated with coronary heart disease.[126] Tensions arise when the pace of work is fast, rendering workers unable to spend as much time as they feel appropriate with each client. Understaffing in hospitals as a result of budget cuts can subject hospital workers to such conditions.[127]

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124. T. Suurnäkki, J. Ilmarinen, G. Wagar, E. Jarvinen and K. Landau, "Municipal employees' cardiovascular diseases and occupational stress factors in Finland," *International Archives of Occupational and Environmental Health*, 59, 1987, pp. 107-114.

125. C. Brisson, A. Vinet, M. Vézina and S. Gingras, "Effect of duration of employment in piecework on severe disability among female garment workers," *Scandinavian Journal of Work, Environment and Health*, 15, 1989, pp. 329-344.

M. Vézina, A. Vinet and C. Brisson, "Le vieillissement prématuré associé à la rémunération au rendement dans l'industrie du vêtement," *Le travail humain*, 52, 1989, pp. 203-212.

126. D.M. Reed, A.Z. Lacroix, R. Karasek et al., "Occupational strain and the incidence of coronary heart disease," *American Journal of Epidemiology*, 129, 1989, pp. 495-502

127. P. Armstrong, "Where have all the nurses gone?" *Healthsharing*, Summer, 1988, pp. 17-19.

Although feelings of being stressed, exhausted, and suffering from burnout are well-known in jobs where women deal with clients,[128] little research has related them to specific aspects of working conditions.

Repetitive work with the hands

One of the characteristics people most detest about their work is repetition. Hospital laboratory technicians repeat the same procedures over and over. Cashiers, typists and data entry operators enter numbers and letters on keyboards all day. Women factory workers tend to be concentrated in jobs where they make rapid repetitive hand movements. The effects of boring, repetitive work on the minds of workers has not been well documented. This type of work has been associated with anxiety attacks,[129] although it is sometimes difficult to distinguish between the effects of anxiety and those of indoor air pollution (see below).[130]

Industrial tasks done by women often involve lifting relatively light weights, many times, at a fast pace. This type of job can be painful and can eventually result in neurological and musculo-skeletal problems such as carpal tunnel syndrome and tenosynovitis of the wrist.[131] A study of garment workers in Massachusetts showed that 42 percent had persistent pain, of whom most had wrist pathologies.[132] Studies of

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128. J.B. Brookings, B. Bolton, C.E. Brown and A. McEvoy, "Self-reported job burnout among female human service professionals," *Journal of Occupational Behaviour*, 6, 1985, pp. 143-150.

129. R.W. Alexander and M.J. Fedoruk, "Epidemic psychogenic illness in a telephone operators' building," *Journal of Occupational Medicine*, 28, 1986, pp. 42-45.

130. J.S. Faoust and L.B. Billiant, "Is the diagnosis of "mass hysteria" an excuse for incomplete investigation of low level environmental contamination?" *Journal of Occupational Medicine*, 23, 1981, pp. 22-26.

A. Yassi, J.L. Weeks, K. Samson and M.B. Raber, "Epidemic of "shocks" in telephone operators: lessons for the medical community", *Canadian Medical Association Journal*, 140, 1989, pp. 816-820.

131. K. Kurppa, P. Waris and P. Rokkanen, "Peritendinitis and tenosynovitis: A review," *Scandinavian Journal of Work, Environment and Health*, 5, suppl. 3, 1979, pp. 19-24.

132. L. Punnett, "Soft tissue disorders in the upper limbs of female garment workers," *Scandinavian Journal of Work, Environment and Health*, 11, 1985, pp. 417-425.

American garment workers[133] and Scandinavian workers in an electrical equipment plant[134] showed high levels of shoulder and elbow problems. If women lift weights at a fast pace, they will lift more total weight and be at a higher risk of problems associated with this activity.

Mental workload

Just as a job may involve a physical workload which affects the workers' health, it may also involve a mental workload. Mental workload is a concept that has been developed to describe the mental component of tasks.[135] Often the complexity of women's work does not appear in their task descriptions. For example, the registrar's office of a large university forbade data entry clerks to do any programming; in order to do the job properly, the clerks had to program in secret.[136]

Several tools and concepts have been developed to standardize perceptions of mental components of tasks in the workplace. For example, Robert Karasek[137] has rated jobs according to demands made on workers and their degree of control over the work. Others have specialized in studying determinants and components of well-being in typical women's jobs.[138] A group at the Finnish Institute of Occupational Health develops measures of stressors and their effects in

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133. *Ibid.*

134. G. Hagg and J. Suurkula, *Relations between shoulder/neck disorders and myoelectric signs of local muscle fatigue in female assembly workers*, Proceedings of the 1984 International Conference on Occupational Ergonomics, 1, 1984, pp. 324-327.

135. N. Moray, "Mental workload since 1979," *International Reviews of Ergonomics*, 2, 1979, pp. 123-150.

136. C. Teiger and C. Bernier, "Intérêt de l'analyse ergonomique du travail pour la mise en évidence des compétences méconnues: le cas de tâches de saisie dans le tertiaire informatisé." In C. Brabant and K. Messing (eds.), *Le sexe faible ou le travail trop ardu: La recherche sur la santé des travailleuses*. Cahiers de l'ACFAS. Association canadienne-française pour l'avancement des sciences. Montreal, 1990.

137. R.A. Karasek, "Job demands, job decision latitude and mental strain: Implications for job redesign," *Administrative Science Quarterly*, 24, 1979, pp. 285-308.

138. T. Cox, M. Thirlaway and S. Cox, "Occupational well-being: Sex differences at work," *Ergonomics*, 27, 1984, pp. 499-510.

women's jobs.[139] An exhaustive review of the North American research on mental task components, including physiological measurements, concludes that the most reliable and reproducible existing measurements are subjective; that is, the worker reports her own degree of difficulty with different aspects of the task.[140]

Mental workload in itself is not necessarily too heavy, any more than physical workload; in the case of an interesting job, it may even be an important component of job satisfaction. But when a heavy mental workload is combined with a boring, repetitive task, workers are obliged to concentrate constantly on their movements instead of being able to occupy their minds with more pleasant images and ideas. Ergonomists at the Conservatoire national des arts et métiers in Paris, for example, described the intense mental effort required of women glove makers, who have to figure out, at the intense speeds of a production line, how to match the often badly-cut halves of a glove without leaving lumps. This heavy mental load may explain in part why workers do not last very long at this job.[141]

Standing/immobile position

Standing without moving for long periods is characteristic of many women's jobs, for example, in sales (cashiers, tellers, store clerks), in laboratories, and on factory assembly lines. Studies indicate that this position exerts a demand on leg muscles, causing pain,[142] and impedes blood circulation, causing swelling.[143]

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139. K. Kauppinen-Toropainen, I. Kandolin and P. Mutanen, "Job dissatisfaction and work-related exhaustion in male and female work," *Journal of Occupational Behaviour*, 4, 1983, pp. 193-207.

140. N. Moray, "Mental workload since 1979," *International Reviews of Ergonomics*, 2, 1988, pp. 123-150.

141. C. Teiger, "Les contraintes du travail dans les travaux répétitifs de masse et leurs conséquences sur les travailleuses." In Bouchard, J.-A. (ed.), *Les effets des conditions de travail sur la santé des travailleuses*, Confédération des syndicats nationaux, Montreal, 1984, pp 33-68.

142. E.N. Corlett and R.P. Bishop, "A technique for assessing postural discomfort," *Ergonomics*, 19, 1976, pp. 175-182.

143. R.L. Waterfield, "The effect of posture on the volume of the leg," *Journal of Physiology*, 72, 1981, pp. 131-136.

In poultry slaughterhouses, workers who stood for a long time cutting up and eviscerating chickens experienced leg pain, cramps, numbness and swelling in the lower legs and feet.[144] Similar symptoms have been found in saleswomen who are required to remain standing.[145]

Studies of pregnant women whose jobs involved standing for more than two hours without a break found that these women nearly doubled their risk of varicose veins[146] and significantly increased their risk of miscarriage and stillbirth.[147]

Exposure to indoor air pollution

In the Quebec study of the distribution of women's and men's jobs, cited earlier (see footnote 10), one characteristic of women's jobs was that they tended to be indoors. A person who receives and directs people indoors is a female receptionist; a person who receives and directs people outdoors is a male parking lot attendant or security guard. Thus, many women work indoors in offices and institutions where indoor air pollution has recently been recognized as a health problem.[148]

Complaints about discomfort, headaches and respiratory problems were heard from university staff whose offices were located in buildings with laboratories, where contaminated air found its way into the general ventilation system.[149] Even when there are no laboratories in the same

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144. D. Mergler, N. Vézina, A. Beauvais and J. Everell, *A study of the effects of working conditions on the health of slaughterhouse workers*, Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, Report no. 0475, 1982, 75 pp.

145. E. Grandjean and W. Hunting, "Ergonomics of posture: Review of various problems of standing and sitting posture," *Applied Ergonomics*, 8, 1977, pp. 135-140.

146. N. Cherry, "Physical demands of work and health complaints among women working late in pregnancy," *Ergonomics*, 8, 1987, pp. 135-140.

147. A.D. McDonald, J.C. McDonald, B. Armstrong, et al., "Fetal death and work in pregnancy," *British Journal of Industrial Medicine*, 45, 1988, pp. 148-157.

148. J.M. Samet, M. Marbury and J.D. Spengler, "Health effects and sources of indoor air pollution," *American Review of Respiratory Disease*, 1988,1989. Part I, 136, pp. 1487-1508, and Part II, 137, pp. 221-242.

149. J. Farant, *Investigation de la qualité de l'air : Pavillon Marie-Victorin*, Université de Montréal. Laboratoire d'hygiène du milieu, School of Occupational Health, McGill University, Montreal, Quebec. 1986. 20 pp. plus appendices.

buildings, poor ventilation may result in contaminants accumulating in the air, especially where there are smokers. The problem of polluted air is most critical in restaurants and bars with poor ventilation, where levels have been found that exceed those permitted in factories.[150] A British Columbia study showed that waitresses and bartenders had a higher-than-average risk of lung cancer, presumably related to breathing second-hand smoke.[151]

Microbial contamination was first brought to public attention with the recognition of Legionnaire's disease. Since then, studies have shown bacterial and fungal contamination in humidifying and air conditioning systems in hospitals[152] and offices.[153] Although workers frequently complain of inadequate temperature control and insufficient humidification of indoor air, the health effects of these conditions have not been extensively studied.

Job instability/unemployment

As noted in Section 1, women are more likely than men to be underemployed and to have short-term jobs, and Canadian women aged 25 to 45 experience higher unemployment rates than Canadian men in this age group. Aboriginal[154] and disabled[155] women are particularly likely to suffer from job instability. There has not been any major Canadian study on the health effects of female unemployment; however, some Swedish studies have been conducted.[156, 157]

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150. J.M. Stellman and M.S. Henifin, *Office Work Can Be Dangerous to Your Health*, Pantheon, New York, 1983, p. 146.

151. J. Dimich-Ward, R.P. Gallagher, J.J. Spinelli et al., "Occupational mortality among bartenders and waiters," *Canadian Journal of Public Health*, 79, 1988, pp. 194-197.

152. R.S. Martin, T.J. Marrie, D. Haase and R.K. Sumarah, "An environmental study of a nosocomial outbreak of legionellosis in a city hospital," *Canadian Journal of Public Health*, 79, Nov.-Dec., 1988, pp. 440-442.

153. *Supra*, Note 148.

154. *Supra*, Note 23.

155. J. Ridington, *Different Therefore Unequal: Employment and Women with Disabilities*, DisAbled Women's Network Canada, Vancouver, B.C., 1989, p. 2.

156. S-O. Brenner and L. Lennart, "Long-term unemployment among women in Sweden," *Social Sciences in Medicine*, 25, 1987, pp. 153-161.

157. S. Starrin and G. Larson, "Coping with unemployment: A contribution to the understanding of women's unemployment," *Social Sciences in Medicine*, 25, 1987, pp. 16-71.

One study followed psychological and biochemical parameters among 400 unemployed women and controls during the first two years of unemployment. Stress rose right after job loss, as shown by psychological (General Health Questionnaire) and biochemical (cortisol) indicators, and the immune system changed over a longer period.[158] It should be noted that, in Sweden, unemployed workers receive 90 percent of their salary for one year, so the effects of unemployment cannot be attributed to nutritional differences or economic need.

Double work day

About half of Canadian women workers live with their children.[159] It is well documented that women have the major responsibility for housework and family responsibilities whether or not they are also in the paid work force.[160] A 1987 Quebec study, for example, found that full-time homemakers worked three times as many hours as men on house chores, while women with outside jobs worked twice as many hours as men.[161] Most research has concentrated on the mental health costs of "role conflict" between family and workplace functions[162] rather than the physiological costs of this "double work day," which averages about 70 hours per week.[163] However, some studies, including the Framingham Heart Study, have found that marriage and children added to the risk of heart disease among female office staff.[164] As well,

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158. B. Arnetz, J. Wasserman, B. Petrini et al., "Immune function in unemployed women," *Psychosomatic Medicine*, 49, 1987, pp. 3-12.

159. Statistics Canada, 1986 Census. *Population and Dwelling Characteristics, Occupation*. The Nation. Ottawa, March 1989. Catalog No. 93-111.

160. D. Berardo, C.L. Shehan and G.R. Leslie, "A residue of tradition: Jobs, careers and spouses' time in housework," *Journal of Marriage and the Family*, 49, 1987, pp. 381-390.

161. *Supra*, Note 27.

162. K. M. Semchuk and J. M. Eakin, "Children's health and illness behaviour: The single working mother's perspective," *Canadian Journal of Public Health*, 80, 1989, pp. 346-350.

163. M. De Koninck, "Double travail et santé des femmes," *Santé mentale au Canada*, 32, 1985, pp. 14-17.

164. S.G. Haynes and M. Feinlib, "Women, work and coronary heart disease," *American Journal of Public Health*, 70, 1980, pp. 133-141.

a Quebec study of female hospital workers showed that the more domestic work was added to difficult working conditions, the more exhausted women felt at the end of the day, and the more likely they were to suffer from insomnia.[165]

Sexual harassment

Very little is known about the effects of sexual harassment, which is only beginning to be recognized as a stressor in women's jobs.[166] It can be most difficult to cope with for women who are entering jobs previously reserved for men, since their numbers are low and they often work in isolation from each other. A study commissioned by the Montreal Urban Community Police found that over 30 percent of 250 policewomen had been victims of sexual harassment by their colleagues.[167] Sexual harassment can be manifested in even more serious assault. For example, in the U.S., it has been estimated that there are between 156 and 710 cases of rape in workplaces every year.[168]

Recently, individual women have tried to get compensation for their sufferings due to sexual harassment. In 1984, the Quebec Workers' Compensation Commission recognized stress due to sexual harassment as a compensable injury, and in 1987, the Ontario Labour Relations Board brought stress due to sexual harassment within the scope of the Ontario health and safety legislation. In both cases, the harassed women reported digestive problems, insomnia and tension.

Shift work

Many jobs make it difficult to sleep at the time when the human body is ready for sleep. Many large office buildings are cleaned only at night, health care institutions must be staffed 24 hours a day, and many

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165. *Supra*, Note 28.

166. Women's Bureau. Labour Canada. *Sexual harassment*. Bibliography. Labour Canada, Ottawa, 1981, 7 pp.

167. S. Colpron, "Le harcèlement sexuel est florissant au service de police de la CUM," *La Presse*, March 23, 1989, pp. A1-A2.

168. P.J. Seligman, S.C. Newman, C.L. Timbrook and W.E. Halperin, "Sexual assault of women at work," *American Journal of Industrial Medicine*, 12, 1987, pp. 445-450.

factories have evening and night shifts. In addition to jobs involving shift work, many jobs require work outside the nine to five time slot: school bus driving requires the worker to get up very early; restaurant and entertainment work requires staying up late at night.

Hormones and other chemicals are produced cyclically in the human body.[169, 170] Body temperature changes during the day, also cyclically. These cycles make it ideal for most people to sleep at night and work during the day. The major cost of not following the body's natural rhythm is, of course, feeling tired. Shift workers describe needing to drink plenty of coffee to keep awake at work and then needing sleeping pills to get to sleep when they can. A Swedish study has found more than average sleep and stomach disorders, fatigue, irritation and aggression among shift workers, especially older workers,[171] and a Quebec study of hospital workers showed a relationship between insomnia and more than four years of shift work.[172] In addition, several studies have found that shift work raises the likelihood of miscarriage.[173]

Shift work can be stressful because it may hurt family and social life. It is hard to maintain a social life when one is awake while the rest of the world is sleeping, and vice versa.

Shift work may be particularly stressful for women with children. Child care and household tasks may prevent the woman from sleeping during the day, and arrangements for child care are very hard to find if the woman works outside "normal" hours.

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169. J.E. Froberg, *The Twenty-Four Hour Workday: Proceedings of a Symposium on Variations in Work-Sleep Schedules*, Division of Biomedical and Behavioural Science, National Institute of Occupational Safety and Health, Cincinnati, Ohio, 1981.

170. R.M. Coleman, *Wide awake at 3:00 A.M.*, W.H. Freeman Co., New York, 1986, 195 pp.

171. *Supra*, Note 169.

172. M. Dumont and J. Montplaisir, *Prévalence des troubles du sommeil et de la vigilance dans une population d'anciennes travailleuses de nuit*, Proceedings of the Human Factors Association of Canada, 1, 1987, pp. 111-114.

173. L. Goulet and G. Thériault, "Association between spontaneous abortion and ergonomic factors," *Scandinavian Journal of Work, Environment and Health*, 13, 1987, pp. 399-403.

Exposure to chemicals and other toxic agents

Both women and men may be exposed to chemicals at work. Since the mid 1940s, the chemical industry has doubled in size and production every seven or eight years.[174] There are over 100,000 chemicals in the workplace, and the American Conference of Governmental and Industrial Hygienists has sufficient information to set exposure limits for fewer than 0.5 percent of them. As of 1984, complete data was available for only 18 percent of drugs, 10 percent of pesticides, and less than 10 percent for all other classes of chemicals.[175] Information on industrial chemicals is available from various data bases and sources,[176] but it will be a long time before information catches up to the number of chemicals. In addition, women's physiology may be, on the average, somewhat different from men's, and pregnant women's from other women's (see Section 5). Since most chemical testing has been done without special attention to this question, it is possible that standards devised with mainly men in mind are inappropriate for women.[177]

The effect of chemicals depends on their form and on their target organ. A dust may be absorbed by breathing and thus affect the lung, but if particles are small they may also be absorbed into the bloodstream and affect other organs. A detergent or solvent may attack the skin, but may not be limited to it.

Thus, the effects of chemicals may be complex. A discussion of all toxic effects is beyond the scope of this paper. However, one kind of toxic effect not only is irreversible, but surpasses the effect on the individual exposed worker. Genetic damage is damage to cells which is passed on

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174. D.L. Davis and B.H. Magee, "Cancer and industrial chemical production," *Science*, 206, 1979, pp. 1356-1358.

175. P. Leeper, *Finding the bad actors in a world of chemicals*, News Report of the National Academy of Sciences, the National Academy of Engineering, and the National Research Council, 34(3), 1984, pp. 4-10.

176. For example, the Canadian Centre for Occupational Health and Safety in Hamilton, Ontario, has a free telephone information service combined with access to various data bases. Canadian law now provides in principle for worker access to detailed information on chemical exposures. See also the American source: J. Stellman, S. Daum, *Work is Dangerous to Your Health*, Vintage Books, New York, 1973.

177. E.J. Calabrese, *Toxic Susceptibility: Male-Female Differences*, Wiley Interscience Publication, John Wiley and Sons, Toronto, 1985, 336 pp.

to descendants forever, due to effects on the genetic material (chromosomes). Genetic damage may result in mutagenesis (damage to eggs, sperm, or other cells such as white blood cells) or carcinogenesis (production of a cancer). In general, mutagenic substances are also carcinogenic, and vice versa. Mutagenesis in humans can be revealed by studies of sperm, of pregnancy outcome, or of certain biological signs.[178] Agents causing genetic damage and commonly encountered in the workplace are ionizing radiation, certain solvents, some pesticides, tobacco smoke, some dyes, and most medication used to treat cancer patients.

Accidents

Although accidents are relatively infrequent in women's traditional jobs,[179, 180] certain occupations are associated with high risks. Women in industrial jobs who work with knives or scissors risk cutting themselves.[181] Farm and other workers may catch clothing, hair and skin in machines lacking appropriate guards and shields. Hospital workers have a high incidence of back injuries due to moving patients.[182]

Risk of accidents may be compounded by fatigue, due to the double work day or a too-fast work pace. In addition, as will be discussed more extensively in Section 5, average-sized women who use equipment designed for the average-sized man may be exposed to an increased risk of accidents.

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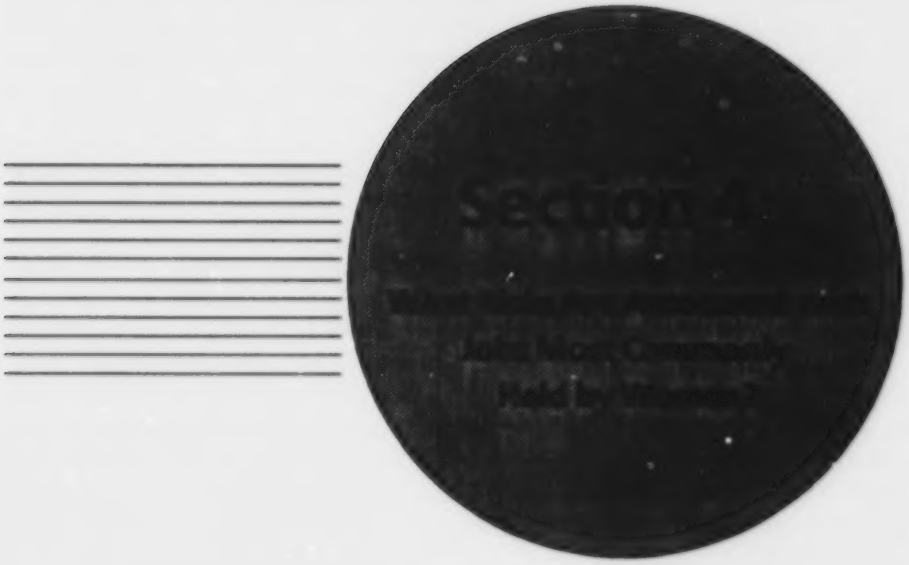
178. M. Sorsa and H. Norppa, *Monitoring of Occupational Genotoxicants*, Alan R. Liss, New York, 1986, 250 pp.

179. J.C. Robinson, "Trends in racial equality and inequality and exposure to work-related hazards, 1968-1986," *AAOHN Journal*, 37, 1989, pp. 56-63.

180. In Canada accident statistics have not been separated by sex. In France, men have five times as many industrial accidents as women. D. Kergoat, *Les ouvrières*, Le Sycomore, Paris, 1982, pp. 48-49.

181. D. Mergler, N. Vézina and A. Beauvais, "Warts among workers in poultry slaughterhouses," *Scandinavian Journal of Work, Environment and Health*, 8 (suppl. 1), 1982, pp.180-184.

182. M. Lortie, "Structural analysis of occupational accidents affecting orderlies in a geriatric hospital," *Journal of Occupational Medicine*, 29, 1987, pp. 437-444.


Section 4

This section discusses the known risks associated with the most common traditional women's jobs, previously presented in Table 1. Many of the risks associated with the jobs profiled in this section have already been discussed in greater detail in Section 3. Therefore they are only briefly reviewed at the beginning of each job description. Some occupations that share risk factors have been presented together. The reader will notice that, aside from office and hospital workers and, increasingly, farm workers, there has been little study of most of the occupations where a large number of women work. For several occupations, descriptions of working conditions have not yet been complemented by systematic study of health effects.

Office workers, including secretaries, clerks, data entry operators, receptionists, financial officers, sales supervisors

As shown in Table 1 (p. 19), office workers represent the largest occupational group of women. Office workers often must deal with superiors and colleagues under pressures of production which in some cases can resemble factory assembly lines. They are also exposed to a variety of possible indoor air problems, as previously discussed. Office workers are more fortunate than other workers in that they have access to information concerning most risks associated with their occupations, in much more detail than it is possible to provide in this paper.[183] The most common risk factors associated with office jobs traditionally held by women are covered below.

- Fast, repetitive work while immobile

  Typists, data entry operators and accounting clerks do repetitive work under time pressure while sitting still for long periods. Multiple repetitive strain injuries, especially to the wrist, are associated with fast repetitive work with the hands (see previous section). Risks associated with the stress reaction have been discussed above.

  A comfortable position is important for work in prolonged sitting positions. Backache and swollen legs are possible effects of a work station which does not allow for adjustment of chair height, chair back angle and distance from the working surface.

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183. J.M. Stellman and M.S. Henifin, *Office Work Can Be Dangerous to Your Health*, Pantheon, New York, 1983.

- Video display terminals (VDTs)

  VDTs are used by clerical workers, typists, telephone operators, tellers, cashiers and clerks, a majority of whom are women. A lot of emphasis in the press has been placed on radiation emitted by VDTs and the possible danger to foetuses. Several kinds of radiation have been mentioned. Ionizing radiation, like X-rays, is emitted in small quantities from some machines, but this is exceptional; most VDTs do not emit detectable quantities of ionizing radiation. Electromagnetic radiation may also be emitted, but research is just beginning to be done on its effects. The Swedish National Board of Occupational Safety and Health has produced a report on all aspects of work with VDTs.[184]

  Radiation is probably a much less common risk from VDTs than is muscle strain from cramped positions[185] or eye fatigue from spending too long staring at a screen without a break, especially if lighting conditions are poor.[186] Various studies show eye discomfort and fatigue among VDT users,[187] and a study of university secretaries showed that some of those who used coloured screens had diminished ability to distinguish colours.[188]

  A recent study[189] showed that women using VDTs for many hours per week have a higher frequency of miscarriages than those who use them less often. This study separated secretaries from other users of VDTs and found an association between hours of VDT use

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184. U.O. Bergqvist, "Video display terminals and health," *Scandinavian Journal of Work, Environment and Health*, 10 (supplement 2), 1984, 87 pp.

185. T. Sihvonen, K. Baskin and O. Hanninen, "Neck-shoulder loading in word processor use," *International Archives of Occupational and Environmental Health*, 61, 1989, pp. 229-233.

186. L. Desnoyers and D. LeBorgne, *Vision et milieu de travail*. Institut de recherche appliquée sur le travail, Montreal, Quebec. Volume 1, *La protection oculaire*. Volume 2, *Les taches visuelles*. 1982. 152 pp.

187. L. Rose, "Workplace video display terminals and visual fatigue," *Journal of Occupational Medicine*, 29, 1987, pp. 321-324.

188. S. Bélanger and D. Mergler, *Rapport sur les résultats du test de vision des couleurs pour le groupe de référence non-exposé aux solvants organiques*, Rapport soumis au comité santé-sécurité de l'Université du Québec à Montréal, 1988.

189. M.K. Goldhaber, M.R. Polen and R.A. Hiatt, "The risk of miscarriage and birth defects among women who use visual display terminals during pregnancy," *American Journal of Industrial Medicine*, 13, 1988, pp. 695-706.

and miscarriage among secretaries but not managers and professionals, suggesting that ergonomic risks rather than radiation could be responsible for the effect. However, other studies have shown no relationship between VDT use and effects on pregnancy.[190] A task force commissioned by the Quebec Institute for Research in Occupational Safety and Health found that the effects of VDTs on health, including the health of pregnant women, depended more on how the machines were used than on the machines themselves. The authors suggested study of work organization, postures and work speed in relation to VDT use.[191] Studies must be considered incomplete and inconclusive until information is available on work postures and work speed in relation to pregnancy outcome of VDT users.

The ergonomic aspect of VDT work is particularly important when workers' jobs involve only typing numbers or letters mechanically into the machine. For example, in some Canadian companies, data entry operators have been required to enter 15,000 characters per day, with production monitored by the software in the machine.[192] The effects on mental health are not surprising. A study showed that data entry operators had a high frequency of mental health symptoms such as anxiety, depression, aggression, and problems with concentrating and remembering, with their prevalence increasing with the time spent doing the job.[193] An American study showed similar results.[194] The fact that a typist using a VDT no longer needs to change paper or erase means that her work posture is less variable. This may increase the likelihood that she spends long hours without moving, with the consequences described in the previous section.

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190. For example, A. McDonald, N. Cherry, C. Delorme and J.C. McDonald, "Visual display units and pregnancy," *Journal of Occupational Medicine*, 28, 1986, pp. 1126-1131.

191. R. Pineault, D. Berthelette, J. Bures et al. *Report of the task force on video display terminals and workers' health*, Study S-003, Institut de recherche en santé et en sécurité du travail du Québec, 1984.

192. S. Bélanger, "Les femmes et la technologie," *Santé mentale au Canada*, September, 1984, pp. 29-31.

193. A. Billette and J. Piché, "Organisation du travail et santé mentale chez les auxiliaires en saisie des données," *Santé mentale au Québec*, X, 1985, pp. 86-98.

194. J.M. Stellman, S. Klitzman, G.C. Gordon and B.R. Snow, "Work environment and the well-being of clerical and VDT workers," *Journal of Occupational Behaviour*, 8, 1987, pp. 95-114.

However, VDTs have also been used creatively to improve the work environment.[195] Women's interest in their work was increased in one company when management organized each job into several task components so that no one person was spending her whole day at the machine. Several studies suggest that workers' health suffers when the whole day is spent working on a VDT.[196]

- Chemicals

  Common chemicals found in offices are described in detail in *Office Work Can Be Dangerous to Your Health*.[197] Concentrations of most chemicals in offices are very low and do not pose the kinds of risks that one finds in factories. However, the combined effect of small doses of pollutants is unknown, and office buildings that share space with factories, laboratories or garages may have higher than average exposures. In addition, emissions of ozone gas from photocopy machines may reach dangerous or at least uncomfortable levels if ventilation is inadequate. Genetic changes have been noted in laboratory animals exposed to ozone; therefore, it would be worthwhile to study whether exposure to ozone is correlated with negative reproductive effects and cancer in humans.

- Noise and light problems

  Computer printers, business machines, multiple telephones and overcrowding may combine with incomplete room dividers and lack of soundproofing to produce noise at very high levels. These are not usually loud enough to cause deafness but can be important stressors. Inadequate or too-bright lighting can also be a stressor.

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195. M. Cohen and M. White, *The impact of computerization on the clerical work process*, Microtechnology Research Group, Burnaby, British Columbia, 1988, 48 pp.

196. *Supra*, Note 194.

197. J.M. Stellman and M.S. Henifin, Pantheon, New York, 1983.

Hospital work including nurses, nurses' aides

Hospitals have been classed by the U.S. National Institute of Occupational Safety and Health (NIOSH) as a high-risk workplace.[198] A task force recommended immediate studies of sickness, death and reproductive risks among hospital personnel. Hospital workers are injured twice as often as other service workers. They are exposed to at least 179 skin and eye irritants and 135 agents producing a risk of cancer or reproductive effects.[199] In addition, they may suffer from shift work, emotional problems and, in psychiatric wards, aggression from patients.[200]

Hospital work shares many of the common characteristics of women's jobs. Recent cuts in public spending and the aging of the Canadian population have increased the workload of hospital workers, resulting in complaints of a too-fast pace of work, especially where the worker must respond to sick people. A recent article describes the effects of work on Canadian nurses, increasing numbers of whom are on irregular schedules, split shifts, or on call. Increased stress comes not only from the heavier workload, but also from the fact that workers have fewer opportunities to develop relationships with co-workers or patients.[201]

Women hospital workers are still clustered near the bottom of the hierarchy, with the lowest salaries. According to a U.S. study, they are still primarily nurses, attendants, orderlies, and technicians and are responsible for various kinds of specialized therapies (e.g., physiotherapy, speech therapy).[202]

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198. R.T. Gun et al., *Report of the DSHEFS Task Force on Hospital Worker Health*, U.S. Department of Health and Human Services, 1985, 80 pp.

199. G.S. Omenn and S.L. Morris, "Occupational Hazards to Health Care Workers," *American Journal of Industrial Medicine*, 6, 1984, pp. 129-137.

200. J.J. Gestal, "Occupational hazards in hospitals: accidents, radiation, exposure to noxious chemicals, drug addiction and psychic problems, and assault," *British Journal of Industrial Medicine*, 44, 1987, pp. 510-520.

201. *Supra*, Note 127.

202. I.H. Butter, E.S. Carpenter, B.J. Kay and R.S. Simmons, "Gender hierarchies in the health labour force," *International Journal of Health Services*, 17, 1987, pp. 133-149.

Hospital workers on evening, night or irregular shifts may suffer consequences as described in the preceding section. A Swedish study showed low birthweight among children of non-smoking hospital workers on such shifts, compared with children of regular day workers.[203]

- Back pain and injuries

  In general, studies report an incidence of backache among hospital workers between 40 percent and 80 percent. In a British study, 43.1 percent of nurses complained of back pain, mostly in the lower back.[204] Male and female nurses had the same incidence of back pain, although in women it was often attributed to menstruation. In addition, as nurses got older, they were more likely to suffer from back pain.

  A Finnish study showed a much higher incidence of back pain, 80 percent, among nurses and nurses' aides.[205] This study distinguished between occasional and continuous back pain. Although occasional back pain was more often experienced by young workers, experience of constant pain increased with age. Again, some workers only experienced lower back pain while menstruating.

  A Canadian study showed that 28 percent of work accidents of male and female orderlies involved back injuries resulting from the handling of patients or other heavy weights.[206] A comparative study of weight lifting by nurses' aides and warehouse workers pointed out that the former group (six men and 18 women) lifted weights for longer periods and in more uncomfortable positions and were more apt to have back injuries.[207]

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203. G. Axelsson, R. Rylander and I. Molin, " Outcome of pregnancy in relation to irregular and inconvenient work schedules," *British Journal of Industrial Medicine*, 46, 1989, pp. 393-398.

204. D.A. Stubbs, P.W. Buckle, M.P. Hudson, et al., "Back pain in the nursing profession," *Ergonomics*, 26, 1983, pp. 755-765.

205. T. Videman, T. Nurminen, S. Tola, et al., "Low-back pain in nurses and some loading factors of work," *Spine*, 9, 1984, pp. 400- 404.

206. *Supra*, Note 182.

207. A.-S. Ljungberg, A. Kilbom and G.M. Hagg, "Occupational lifting by nursing aides and warehouse workers," *Ergonomics*, 32, 1989, pp. 59-78.

- Infections and illnesses

  In the United States, hospital workers submit more health insurance claims than others for various types of infections.[208] Not only are there many kinds of germs in hospitals, but the germs have become resistant to treatment due to over-exposure to antibiotics. Workers may be exposed directly to patients or to their blood in laboratory jobs. This is especially true where staff are too rushed to give proper attention to disinfecting rooms, food trays, clothing and equipment.

  Hepatitis B infection is very common in hospitals, due to handling of blood and accidental needle pricks. A serum analysis of 388 workers in Toronto's Hospital for Sick Children showed exposure to hepatitis B in 10 percent of those who worked in areas, such as haematology, where there was exposure to blood.[209] Hospital cleaners' and laundry workers' risks may be high, due to inadequate labelling of wastes and soiled clothing.

  Hospital workers are concerned about possible exposure to the AIDS virus, particularly through needle injuries. A very few cases of AIDS transmitted in this way have been reported, but it is generally agreed that AIDS infection is much less likely than hepatitis infection.[210]

- Radiation and chemicals: Anaesthetic gases, ethylene oxide, anti-neoplastic drugs

  Hospital workers are exposed to a wide variety of chemicals and sources of radiation. Operating room personnel may have more reproductive problems than other workers due to exposure to anaesthetic gases where there is inadequate ventilation and gas

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208. J.J. Gestal, "Occupational hazards in hospitals: Risks of infection," *British Journal of Industrial Medicine*, 44, 1987, pp. 435-442.

209. S.M. King et al., "Prevalence of hepatitis B surface antigen and antibody (Hepatitis B virus markers) in personnel at a children's hospital," *American Journal of Epidemiology*, 126, 1987, pp. 480-483.

210. K.D. Elmsley, "Occupational exposure to the human immunodeficiency virus among health care workers in Canada," *Canadian Medical Association Journal*, 140, 1989, pp. 503-505.

recovery.[211, 212] Biological monitoring of personnel who come in contact with anti-cancer drugs and treatments (e.g., radiotherapy technicians,[213] hospital pharmacists,[214] nurses giving chemotherapy[215]) shows that they are more likely than other workers to have mutagenic damage. Workers who sterilize equipment and supplies used in the operating room are exposed to ethylene oxide, a gas which has been shown to affect the nervous system at high doses and signs of negative effects on pregnancy at lower doses.[216] Laboratory workers are exposed to many different chemicals, including solvents, which can affect the nervous system.

- Accidents and assaults

  A Canadian study analyzed 662 work accidents of male and female orderlies.[217] Women and men had the same number of accidents per worker. Women most often reported accidents handling patients, turning them or moving them to the head of the bed. Men, on the other hand, reported accidents lifting and transferring weights.

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211. R.P. Knill-Jones, D.D. Moir, L.V. Rodrigues and A.A. Spence, "Anaesthetic practice and pregnancy," *Lancet 1*, 1972, pp. 1326-1328, and several other papers. Some recent studies have been negative, but this may be due to improvements in ventilation.

212. P.F. Infante and T.A. Tsongas, "Anaesthetic Gases and Pregnancy: A review of evidence for an occupational hazard." In M. Sorsa, K. Hemminki, H. Vainio, *Occupational Hazards and Reproduction*, Hemisphere Publishing Co., Washington, 1985, pp. 287-294.

213. K. Messing, A.M. Seifert, J. Ferraris, J. Swarz and W.E.C. Bradley, "HPRT mutant frequency of radiotherapy technicians appears to be related to recent exposure," *Health Physics*, 37, 1989, pp. 537-544.

214. J.F. Gibson, D. Gompertz and R.B. Hedforth-Whitty, "Mutagenicity of urine from nurses handling cytostatic drugs," *Lancet 1*, 1984, pp. 100-101.

215. M. Sorsa, K. Hemminki and H. Vainio, "Occupational exposure to anticancer drugs: Potential and real hazards," *Mutation Research*, 154, 1985, pp. 135-149.

216. K. Hemminki, P. Mutanen, I. Saloniemi et al. "Spontaneous abortions in hospital staff engaged in sterilising instruments with chemical agents," *British Medical Journal*, 285, 1982, pp. 1461-1463.

217. M. Lortie, "Analyse comparative des accidents déclarés par des préposés hommes et femmes d'un hôpital gériatrique," *Journal of Occupational Accidents*, 9, 1987, pp. 59-81.

Assault is a risk in psychiatric wards and hospitals. It is particularly feared by pregnant women, and risk of assault has been accepted as a reason for precautionary leave in Quebec. However, no systematic study has been done of assault and the results for the pregnant worker.

Sewing machine operators and other assembly line workers

Assembly line work is not listed as one of the primary women's occupations in Table 1 because Statistics Canada, from whose data the top 20 women's jobs were compiled, separates occupations by industry. Women do most repetitive assembly line work in many industries; sewing machine operator is the most common of these jobs.

Sewing machine operators, like other assembly line workers, frequently do fast repetitive work with their hands, and the operators often work in cramped positions. The work cycle of those who sew pant legs, for example, has been calculated to be six seconds, repeated more than 3,000 times a day.[218] Operators often work in uncomfortable positions without moving around. Their health suffers, compared with other groups of workers, as described in the previous section.[219] Muscular aches and joint problems are very common. Sewing machine operators in Finland had neck, shoulder and leg problems.[220] The short-term and long-term effects of fast-paced work, rapid movements and inability to move around have been described in the previous section.

Assembly line work in general is associated with similar conditions. Among 76 Swedish women who had left an assembly line job within the preceding four years, 26 percent left because of pain. Of those

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218. N. Vézina, F. Tissot and J. Courville, *Analyse ergonomique d'un poste de couturière*. Association paritaire en santé et en sécurité du travail dans le secteur de l'habillement, Montreal, 1988, 77 pp.

219. C. Brisson, A. Vinet and M. Vézina, "Disability among female garment workers," *Scandinavian Journal of Work, Environment and Health*, 15, 1989, pp. 323-328.

220. T. Vihma, M. Nurminen and P. Mutanen, "Sewing machine operators' work and musculo-skeletal complaints," *Ergonomics*, 25, 1982, pp. 295-298.

who stayed at their jobs, 38 percent had experienced pain during the previous seven days, significantly more than a comparison group from the same region.[221] A study in France found that assembly line work in general was associated with high blood pressure.[222]

Assembly line jobs are too varied for a discussion of each element. For instance, food preparation is associated with cuts and cold exposure, sewing machine operators may be exposed to dangerous and even cancer-producing dyes, and workers in pharmaceutical companies are exposed to a variety of chemicals which may lead to reproductive problems.[223] The classic *Work is Dangerous to Your Health*[224] covers many common chemical and other risks of industrial jobs. The following discussion sketches only a few common problems.

- Noise

  Noise is an extremely frequent problem in factories. It can result in industrial deafness, as one would expect, but it is also a major stressor for workers. A Canadian study showed that children of women exposed to loud industrial noise while pregnant showed hearing abnormalities seven years after birth.[225] Noise exposure was associated with low birth weight of children of pregnant workers in manufacturing.[226]

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221. K. Ohlsson, R. Attewell and S. Skerfeving, "Self-reported symptoms in the neck and upper limbs of female assembly workers," *Scandinavian Journal of Work, Environment and Health*, 15, 1989, pp. 75-80.

222. C. Fouriaud et al., "Influence of socioprofessional conditions on blood pressure levels and hypertension control," *American Journal of Epidemiology*, 120, 1984, pp. 72-86.

223. H. Taskinen, M-L. Lidbohm and K. Hemminki, "Spontaneous abortions among women working in the pharmaceutical industry," *British Journal of Industrial Medicine*, 43, 1986, pp. 199-205.

224. J. Stellman and S. Daum, Vintage Books, N.Y. 1973.

225. N. Lalande, R. Hétu and J. Lambert, "Is occupational noise exposure during pregnancy a risk factor of damage to the auditory system of the foetus?" *American Journal of Industrial Medicine*, 10, 1986, pp. 427-435.

226. A.D. McDonald, J.C. McDonald, B. Armstrong et al., "Prematurity and work in pregnancy," *British Journal of Industrial Medicine*, 45, 1988, pp. 56-62.

- **Lighting**

  Since many women's industrial tasks involve inspection or close work, lighting can be very important. The amount of light is significant, but just as important are the type of light (fluorescent, incandescent) and the absence or presence of glare or reflections. Proper conditions for visually demanding work have been described elsewhere.[227]

- **Solvents**

  Many industrial jobs involve exposure to solvents. For example, solvents are components of paints, glues, and cleaning fluids. The semi-conductor industry, which employs mainly women on the assembly line, exposes them to xylene, toluene, and various other solvents.[228] Solvents can attack the nervous system, causing loss of mental functioning and physical capacities.[229] Children of pregnant women exposed to solvents have an increased risk of damage to the nervous system.[230, 231]

- **Industrial home work**

  Some Canadian manufacturers have responded to international competition by fragmenting their production process and relying on sewing or other routine work done by women in their homes. These workers share the problems of other industrial workers, compounded by the fact that they are isolated from unions, fellow workers, and other sources of information and assistance, even more so if they are immigrants. Their extremely low, piecework

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227. *Supra*, Note 186.

228. H. Pastides, E.J. Calabrese, D.W. Hosmer and D.R. Harris, "Spontaneous abortion and general illness symptoms among semiconductor manufacturers," *Journal of Occupational Medicine*, 30, 1988, pp. 543-551.

229. D. Mergler and L. Blain, "Assessing colour vision loss among solvent-exposed workers," *American Journal of Industrial Medicine*, 12, 1987, pp. 195-203.

230. P.C. Holmberg, "Central-nervous system defects in children born to mothers exposed to organic solvents during pregnancy," *Lancet*, v. 2, 8135, July 28, 1979, pp. 177-179.

231. J. Tikkanen and O.P. Heinonen, "Cardiovascular malformations and organic solvent exposure during pregnancy in Finland," *American Journal of Industrial Medicine*, 14, 1988, pp. 1-8.

pay encourages them to work very long hours at very high speeds, enhancing the risk of problems associated with these conditions. In addition, it is unlikely that their homes have been designed to permit comfortable working positions and adequate ventilation.[232]

Waitresses

Restaurant workers share some of the most difficult working conditions. Very little research has been done on this group. One questionnaire study of 311 restaurant workers in a small Canadian city describes extremely hard working conditions and some health problems among this 66 percent female population.[233] The study describes restaurant workers as relatively young; 82 percent of respondents were under 40. Work was extremely unstable; employees changed employers on average once every six months. The system of tips resembles the piecework system which causes so much trouble for assembly line workers: 14 percent of workers reported receiving no salary, only tips.

Many waitresses must deal with sometimes difficult clients, under intense time pressure. Symptoms of a possible stress reaction are tension and irritability. Waiter is one of the occupations reported by Karasek to have "high demand, low control" and therefore to be at risk of coronary heart disease.[234]

Restaurant and night club environments may be smoky and noisy. Bartenders and waitresses may have increased risk of lung cancer, possibly due to passive smoking.[235] One study described noise above the

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232. L. Johnson, *The Seam Allowance, Industrial Home Sewing in Canada*, Toronto, Women's Press, 1982, p. 78.

233. M. Compagnat, "Le monde de l'hébergement et de la restauration," *Santé mentale au Québec*, X, 1985, pp. 114-120.

234. R.A. Karasek, "Characteristics of task structure associated with physiological stress and cardiovascular illness," *Annals of the American Conference of Governmental Industrial Hygienists*, 8, 1984, pp. 27-32.

235. H. Dimich-Ward, R.P. Gallagher, J.J. Spinelli et al., "Occupational mortality among bartenders and waiters," *Canadian Journal of Public Health*, 79, 1988, pp. 194-197.

threshold limit value of 90 decibels during night club performances.[236] Work in restaurants during pregnancy is associated with premature birth and low birth weight.[237] Standing for long periods may be a risk factor.

- Flight attendants

  Flight attendants experience job duties and health risks similar to those of waitresses and, in addition, may be exposed to an inadequate air supply with too much ozone[238] and too little oxygen.[239] Vibrations and shift work are risks, especially for pregnant women.[240]

Hairdressers

A recent article summarizes the occupational health problems of hairdressers, including chemical and ergonomic risk factors.[241] The position of hairdressers is like that of waitresses in that there is a pay system which resembles piecework. Hairdressers spend long hours on their feet and must deal with clients; these characteristics have been examined previously. The work day can be very long, and eating times can be irregular.

- Chemicals

  Hairdressers work with a variety of chemicals, including some that are dangerous and some that may provoke allergic reactions or irritate the skin. Hair dyes have been shown by various

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236. F.J. Darcy, "Noise exposure of live music groups and other employees in night clubs," *American Industrial Hygiene Association Journal*, 38, 1977, pp. 410-412.

237. *Supra*, Note 226.

238. D. Reed, S. Glaser and J. Kaldor, "Ozone toxicity symptoms among flight attendants," *American Journal of Industrial Medicine*, 1, 1980, pp. 43-54.

239. G. Cameron, "Should air hostesses continue flight duty during the first trimester of pregnancy?" *Aerospace medicine*, 44, 1973, pp. 552-556.

240. J. Fuchez, "Maternité et travail dans une compagnie aérienne de transport," *Archives des maladies professionnelles*, 42, 1981, pp. 216-220.

241. H. J. Heacock and J.K. Rivers, "Occupational diseases of hairdressers," *Canadian Journal of Public Health*, 77, 1986, pp. 109-113.

experimental methods to produce genetic changes in test systems.[242] A Quebec government description of risks of hairdressing for pregnant workers describes several other chemical exposures which may be dangerous to the non-pregnant as well as the pregnant worker.[243] Shampoos, permanent wave ingredients, and makeup contain chemicals many of which may cause allergic reactions or dermatitis. Repeated exposure to shampoo may cause skin problems. There have been reports of occupationally induced asthma among hairdressers, due to the inhalation of henna and chemicals found in decolorizing solutions.[244]

Cashiers, sales clerks and tellers

All these workers stand without moving for long periods, and increasing numbers work with video display terminals. They all must deal with the public.

Only a few authors have dealt with the problems faced by these workers.[245, 246, 247] In a British Columbia study, two-thirds of 74 cashiers reported general fatigue. Saturdays, the express check-out line, and staying at the same cash register all day were especially tiring. Low back pain was reported by over two-thirds, and almost one in five suffered from varicose veins. Various other aches and pains were

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242. B. Ames et al., *Hair dyes are mutagenic: Identification of a variety of mutagenic ingredients*, Proceedings of the National Academy of Sciences, 72, 1975, pp. 2423-2427.

243. D. Roberge, *Les salons de coiffure*, Département de santé communautaire, Hôpital Maisonneuve-Rosemont, Ministère des Affaires sociales du Québec, 1982, 17 pp.

244. J. Pepys, "Asthma due to inhaled chemical agents," *Clinical Allergist*, 6, pp. 399-404.

245. U. Wallersteiner, "Occupational health disorders of cashiers in supermarkets," *Proceedings of the Human Factors Association*, 1981, pp. 79-83.

246. M. Godefroy, "Les caissières de magasins," *Travail et sécurité*, 5-82, 1982 pp. 254-273.

247. N. Vézina and J. Courville, *Le travail debout. Étude ergonomique du poste de caissière d'un supermarché*, Université du Québec à Montréal, 1989, 98 pp.

reported, increasing with age. Visual fatigue, due to glare and poor lighting, was also reported by many cashiers.[248] This study presents detailed recommendations for work site design. A recent decision by the Quebec OSH commission underlines the importance of providing seats for cashiers.

The job of cashier is being transformed by the introduction of computerized cash registers. Similar to the adjustments made when VDTs were introduced in offices, the changes in cashiers' tasks depend partly on work organization. Before the introduction of optical readers of product codes, cashiers had to remember the prices of 200 or more items if they wished the flow of purchases to go smoothly. This gave the task an important non-routine character, which is being eliminated.

An American study reports that convenience store cashiers (who often work evenings and nights) run a high risk of sexual assault, as much as 20 times greater than that of other women.[249]

Cooks

This job is being done by an increasing number of women. Its characteristics vary depending on the kitchen. The cook in a large hospital is under different kinds of time pressure from those of a restaurant chef who has several assistants. Cook is one of the professions described by Karasek as "high demand, low control,"[250] characteristics which have been associated with heart disease.

In kitchens, heat is often a major problem which affects the circulatory, excretory and nervous systems. However, reactions to heat depend on task characteristics, such as work speed, the accessibility of a water supply, and whether the worker stays at the same temperature or is

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248. U. Wallersteiner, L.D. Stoffman, G.E. Robertson and T.J. Smith, *Development of a new workstation for cashiers in supermarkets*, Report from Ergu Systems Canada, Inc., Vancouver, B.C. 6 pp. Undated.

249. P.J. Seligman, S.C. Newman, C.L. Timbrook and W.E. Halperin, "Sexual assault of women at work," *American Journal of Industrial Medicine*, 12, 1987, pp. 445-450.

250. *Supra*, Note 234.

exposed to wide temperature swings. Often the types of tasks women traditionally do are not assessed properly for heat exposure;[251] for instance, the fact that the cook works rapidly may not be taken into account.[252] Kitchen workers may be at risk of burns from stoves and hot liquids.[253]

Almost all kitchens are now equipped with microwave ovens. Little information is available on the effects of microwaves on workers. Malfunctioning equipment (e.g., with leaks or defective automatic shut-off mechanisms) has burned workers and produced symptoms such as dermatitis.[254] These ovens produce concentrated heat, which may not be perceived until the worker has already been burned. With ovens built before 1974, which may not conform to Canadian standards, there is a risk that workers may be exposed to enough radiation to cause tissue heating, which may cause cataracts in the eyes or affect a growing foetus. Ovens built more recently should not involve acute risk, but their long-term effects are not known.[255]

Farmworkers

Unfortunately, despite their exposure to many dangerous chemicals, women had to be excluded from a large ongoing study of cancer among farm operators, the "Mortality Study of Canadian Male Farm Operators." The definition of "operator" used by Statistics Canada includes only the farm owner, and women constitute less than 4 percent of this category. In fact, women agricultural workers are often excluded

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251. C. Brabant, S. Bédard and D. Mergler, "Cardiac strain among women workers in an industrial laundry," *Ergonomics*, 32, 1989, pp. 615-628.

252. N. Vézina and R. Khémici, *Évaluation de la charge de travail des employé-es de cuisine de la rôtisserie St-Hubert de Ville St- Laurent*, Report presented to the Appeal Office of the Commission de la santé et de la sécurité du travail du Québec, 1986.

253. W. Inancsi and T.L. Guidotti, "Occupation-related burns," *Journal of Occupational Medicine*, 29, 1987, pp. 730-733.

254. C. Géraut, Rapilly, R. Thibault and D. Dupas, "Les risques médicaux liés à l'utilisation professionnelle des micro-ondes," *Archives des maladies professionnelles*, 49, 1988, pp. 174-176.

255. C. Bariteau, *Risques des fours à micro-ondes pour la santé de la travailleuse enceinte*, Commission de la santé et de la sécurité du travail du Québec, Montreal, Quebec, 12 pp. Undated (circa 1985).

from studies on farmers' health, either for analogous reasons or without any explanation.[256, 257] The scientific literature is thus lacking in information on women agricultural workers. This gap has been filled to some extent by surveys done by women's groups.

According to a recent Quebec study of over 2,000 women farmers, women are involved in animal care, building and grounds maintenance, milking, equipment cleaning, some stable cleaning, and office work such as dealing with suppliers and accounting.[258] These jobs expose women to chemicals, infections, and some grain dusts that cause allergies.[259] A variety of pesticides and fertilizers are used in farm work. This potential hazard is aggravated by the lack of on-site washing facilities. Farmworkers often eat their lunches and suppers with hands still covered with pesticides from the crop they have been working. These may be absorbed and transported in the blood and will sometimes attack the nervous system.[260] Women may also be exposed to the heavier-than-air gases that develop in silos,[261] to animals that kick or charge, and to the health problems associated with working for a piece-rate, in the case of women who are hired to pack fruit or other produce.

Farm women experience allergies, respiratory problems, back pain and reduced sharpness of hearing after years of participating in farm operations. Those working in cereals or hay sometimes develop an ailment referred to as "farmer's lung," or inflammation of the nasal mucous membrane.[262]

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256. A.L. Hallett, "Survey of health and safety behaviour of potato farmers in Carleton County, New Brunswick," *Canadian Journal of Public Health*, 78, 1987, pp. 345-349.

257. J.A. Dosman et al., "Respiratory dysfunction in farmers versus nonfarming rural community control subjects," *Canadian Journal of Public Health*, 77, suppl. 1, pp. 136-139.

258. S. Dion, *Les Femmes dans l'Agriculture au Québec*, Les Éditions la Terre Chez Nous, Longueil, Quebec.

259. G. Busque, "The needs and resources of farm women." In *Growing Strong: Women in Agriculture*, published by Canadian Advisory Council on the Status of Women, 1987, pp. 24-32.

260. Canadian Advisory Council on the Status of Women, *Growing Strong: Women in Agriculture*, Ottawa, November 1987, p. 114.

261. *Ibid*, p. 28.

262. *Ibid*, p. 26.

Reproductive problems have also been reported. Spontaneous abortions, stillbirths and premature births have been attributed to exposure to certain chemicals used in agriculture, which may also contaminate breast milk.[263] Certain infectious agents are also a danger to the reproductive ability of men and women. The reproductive organs of farm workers of both sexes are vulnerable to brucellosis infection, which has been associated with infertility.[264] Salmonellosis infections have been reported by dairy farm families.[265]

- Farm safety

  Women use farm machinery during peak periods, and increasingly at other times, so a consideration of farm safety is relevant to women's health. Farming is one of the most dangerous occupations in Canada, surpassing construction and equalling mining in terms of fatal accidents.[266] In Saskatchewan, it is estimated that one in every four families will at some time suffer an accident to one of its members.[267]

  Farm machinery may be especially dangerous for the average woman, since it has been designed for the average man. (See Section 5 for an extensive discussion of this issue.) For example, women using tractors may experience a wide range of difficulties; e.g., strain from too-heavy attachments, aches and pains from poorly designed seats. Controls adjusted for the average-sized man may be beyond the reach of a small person, increasing the risk of accidents.[268]

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263. E.P. Savage, T.J. Keefe, and J.D. Tessari, "Pesticides in human breast milk." In V.R. Hunt, M.K. Smith and D. Worthy, *Environmental Factors in Human Growth and Development*, Banbury Report No. 11, Cold Spring Harbor, N.Y., pp. 77-84.

264. *Supra*, Note 260.

265. A.M. West, W. Martin and 3 others, "Factors associated with the presence of Salmonella spp. in dairy farm families in southwestern Ontario," *Canadian Journal of Public Health*, 79, 1988, pp. 119-123.

266. Canadian Advisory Council on the Status of Women. *Op. cit.*, p. 27.

267. Mary C. Bohn, *The Impact of Women on the Farm Accident Scene*, Saskatchewan: Unpublished paper, 1988, p. 2.

268. Saskatchewan Safety Council, *Farm Safety Manual*. Regina, Saskatchewan, 1989, p. 4.

Many farm machines such as balers, slathers, combines and rock-pickers are used only during certain seasons of the year when a great deal of work has to be accomplished in a minimum of time. As a result, there are often not enough operating hours to become thoroughly familiar with the machine's potential hazards, and haste and unsafe practices lead to injuries.[269]

Women who operate machinery infrequently may be unfamiliar with the location of levers and controls and with the operation that each one carries out. This problem is compounded by the lack of standardization. Pushing up on a lever on one type of tractor may cause it to go faster; on another type, the same action may cause the vehicle to come to a stop. The potential for rolling or jackknifing is thus increased.

- Stress

A study has shown that, besides working as a full partner in the farm business, many farm women are traditionally expected to have full responsibility for home and family matters.[270] Such a dual role, although common to all working women with children, takes on several added dimensions for the farm woman. First, home and paid work are often in the same location. There is no physical escape from the pressures of family or work. If the woman works off the farm in paid employment, she is afforded a physical separation, but she faces the exhaustion of fulfilling a triple role: family, farm and outside employment. Marginal economic conditions may also constitute a major source of stress for farm women.[271]

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269. Bohn, *Op. cit.*, p. 5.

270. L.J. Walker and J.L. Walker, *The Human Harvest: Changing Farm Stress to Family Success*, Winnipeg: Canada-Manitoba Agri Food Agreement, 1987, p. 12.

271. A.D. Berkowiez, "Stress among farm women: work and family as interacting systems," *Journal of Marriage and the Family*, 46, 1984, pp. 161-166.

Risks to health for farm women may be aggravated by limited access to health care in rural settings. A recent Quebec study showed that life expectancy was rising much more rapidly in urban than in rural areas of the Outaouais region. The study attributed this fact to differences in access to health care, although economic and working conditions may also be important.[272]

Teachers and child care workers

The teacher's work environment can be characterized as similar to that of office workers in terms of the possibility of noise and lighting problems and indoor air pollution. In addition, in day care and elementary and secondary schools, as well as in child care workers, an important stressor is the need to be constantly available for children. There are possible risks to the musculo-skeletal system associated with lifting weights (children). One of the problems being studied is that of infectious disease, a particular problem with younger children and with some types of mentally handicapped children who are particularly likely to carry viral infections.[273]

Reports from journals in educational research[274] describe stress reactions leading to burnout from the anxieties of the first year[275] to the boredom of later periods.[276] These problems are particularly acute in inner-city schools or other areas where there are problems with discipline or apathetic students.

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272. Conseil des affaires sociales, *Deux Québecs dans Un*, Gouvernement du Québec, Gaëtan Morin (ed.), 1989, pp. 85-87.

273. R.S. Remis, M.A. Rossignol and M.A. Kane, "Hepatitis B infection in a day school for mentally retarded students: Transmission from students to staff," *American Journal of Public Health*, 77, 1987, pp. 1183-1186.

274. B. Hiebert and I. Farber, "Teacher stress: A literature survey with a few surprises," *Canadian Journal of Education*, 9, pp. 14-27.

275. M.M. Fimian and L.P. Blanton, "Stress, burnout, and role problems among teacher trainees and first-year teachers," *Journal of Occupational Behaviour*, 8, 1987, pp. 157-165.

276. J.D. Geronimo, *Boredom: The hidden factor affecting teacher exodus*, Clearing House, 59, 1985, p. 178.

Child care workers' health is currently being studied by two Canadian groups: the University of Manitoba[277] and the Department of Community Health in the Maisonneuve-Rosemont Hospital in Montreal.[278]

Cleaners

Cleaners' jobs vary depending on the specific workplace. Cleaners in factories share the other workers' exposures to noise, chemicals and accidents. Night cleaners in offices and banks may suffer from disruption of normal body rhythms. Exposure to chemicals used in cleaning has been associated with skin problems such as dermatitis, eczema and psoriasis.[279] Cleaners in laboratories and hospitals complain of being exposed to dangerous chemicals and radioactivity through careless disposal (see the previous section on hospital workers). Working as a cleaner while pregnant is associated with low birth weight, but the specific exposures responsible for this association have not been documented.[280]

Domestic workers often combine the tasks (and risks) associated with the preceding two categories, cleaning and babysitting. Many of these workers are foreign-born[281] and may suffer from additional stress due to social isolation, as well as low pay and long hours.[282]

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277. Dr. Annalee Yassi, personal communication.

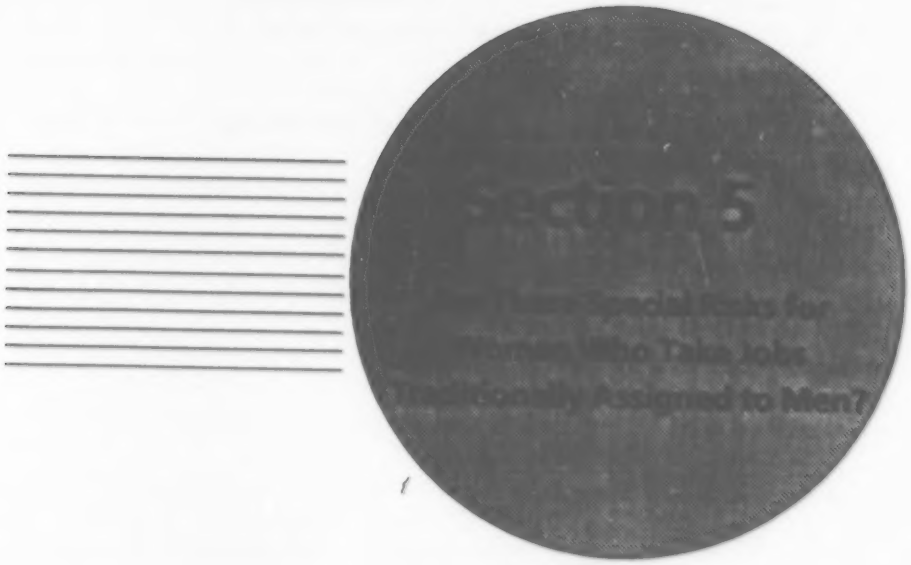
278. Dr. Serge Daneault, personal communication.

279. D.J. Gawkrodger, M.H. Lloyd and J.A.A. Hunter, "Occupational skin disease in hospital cleaning and kitchen workers," *Contact Dermatitis*, 15, 1986, pp. 132-135.

280. *Supra*, Note 226.

281. M. Boyd, "At a Disadvantage: The Occupational Attainments of Foreign Born Women in Canada," *International Migration Review: Women in Migration*, Vol. 18 (1984), p. 1094.

282. S. Seward and K. McDade, *Immigrant Women in Canada: A Policy Perspective*, Ottawa, Canadian Advisory Council on the Status of Women, 1988, pp. 40-41.


Section 5
Special Tasks for
Women Who Take Jobs
Traditionally Assigned to Men?

Are women entering non-traditional jobs?

From 1971 to 1986, the number of employed women increased by 85 percent. Table 4 shows those professions in which the 1971-1986 increase in the number of women substantially exceeded 85 percent. Some of these "growth" job titles resemble those in Table 1, that is, traditional women's jobs. In two cases, they represent nevertheless a movement into what we previously defined as non-traditional jobs (Section 1), those of sales supervisors and of technicians in architecture and engineering.

There has not been a massive movement of women into fields previously reserved for men or great numbers of women encountering new risks. However, pressure from women who want to enter non-traditional jobs is growing. It was mentioned earlier that women's salaries are 65.8 percent of men's, for a full-time year-round job. Women have used two strategies to raise their salaries:

1) up-grade salaries of women's jobs through measures such as equal pay for work of equal value, which ascribe a higher value to the work women ordinarily do; or

2) facilitate women's access to the higher-paid non-traditional jobs.

In Canada, the introduction of employment equity and affirmative action programs may help women gain access to new jobs.

New jobs can result from promotion within an occupational category. In this case the health risks do not change, except that higher income and prestige may have a positive effect on health. New health risks may be encountered, however, when women enter blue-collar or trades jobs which are new for them. For example, a telephone operator who decides to work on telephone lines is at risk of accidents or other health problems.

Women's access to non-traditional jobs may be limited by a number of factors:

1) Attitudes and habits of employers, colleagues, and the women themselves. These may be due to job characteristics which are in conflict with sex stereotypes (e.g., a job considered to be dirty in a way unacceptable for women; it may be considered fitting for a woman to be exposed to human excrement in changing diapers,

but not fitting to be exposed to grease in machine shops). Women may confront direct discrimination, sexual harassment, or daily annoyances and conflicts that discourage them from taking such jobs, which may result in stress-related health problems.

2) The tasks traditionally done by women with families may come in conflict with the job requirements. Women may have difficulty working night shifts or accepting travel away from home due to lack of child care. If they take these jobs, they may suffer fatigue or even exhaustion.

3) Women may be excluded from certain jobs due to dangers, real or supposed, to the foetus if the woman is pregnant.[283] Section 1, however, discussed the fact that conditions which are dangerous for pregnant women often pose a risk for male reproduction.

4) Women may try to do certain jobs designed for large or heavy people and find them physically inaccessible. This is the factor most often cited by women workers as well as colleagues and employers: "No woman could do that job."

The latter stereotype persists despite the fact that there are requirements for physical strength in a number of traditional women's jobs. For example, hospital workers lift heavy weights, usually patients. Laundry workers manipulate 2,000 kg of wet laundry per day.[284]

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283. A. Hricko, "Social policy considerations of occupational health standards: The example of lead and reproductive effects," *Preventive Medicine*, 7, 1978, pp. 394-406.

284. C. Brabant, "Les normes d'exposition à la chaleur et le travail des femmes: équitables ou discutables?" In C. Brabant, K. Messing, "Un sexe faible ou un travail trop ardu: la recherche sur la santé des travailleuses". *Cahiers de l'ACFAS*. Association canadienne-française pour l'avancement des sciences. 1990.

How different are women's bodies from men's?

Women and men are not radically different in their reactions to the workplace or environment.[285] As mentioned earlier, there is no working condition which is dangerous for all women, or even for all pregnant women, and not dangerous for any man. However, the average woman is a different size and shape from the average man.

It is difficult to determine the origins of male/female physical differences. We are born with some differences and acquire others, through variations in extent of physical exercise and training. Whatever the reason, women's health histories are different from men's; women to some extent get different illnesses, at different times, in different ways.

In order to examine the stereotype that women's bodies should be required to do only certain jobs and that some jobs are dangerous specifically for women, it is useful to review information on average male and female anatomy and physiology.

Women and men are, on average, of different size and shape. Some of these differences may require adjustable workplace arrangements.

Women are in general smaller than men and differ in fat and muscle distribution. The Canadian male is, on average, 13 cm taller than the female, but women and men overlap; 10 percent of men are shorter than the tallest 25 percent of women.[286] Almost all the average woman's measurements are smaller than those of the average man; for example, women's hands are about 10 percent smaller than men's.[287] However, men and women are proportioned differently, and the thigh and pelvic

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285. K. Messing, "Do men and women have different jobs because of their biological differences?" *International Journal of Health Services*, 12, 1982, pp. 43-52.

286. M. Jette, *Guide des mensurations anthropométriques des adultes canadiens*, Commission de la santé et de la sécurité du travail du Québec. Montreal, Quebec, 16 pp. Undated.

287. S.H. Snook and V. Ciriello, "Maximum weights and work loads acceptable to female workers," *Journal of Occupational Medicine*, 16, 1974, pp. 527-534.

circumference of the average woman is larger than that of the average man. A consequence of some of these size differences is that the average woman's centre of gravity is lower, her hip joint is somewhat different, her legs are proportionately longer, and her arms shorter than the average man's.[288]

A review of nine studies shows the average man to weigh 13 kg more than the average woman, although 10 percent of men weigh less than the average woman.[289] More than twice as much of the average woman's body weight is fat, although highly trained athletes of both sexes are similar in this respect.

These differences may be of no consequence in most jobs. However, some jobs traditionally reserved for men may have evolved only in relation to the average male body. In fact, some jobs are at the limit of accessibility to men; that is, they may be accessible without adjustment only to the tallest, heaviest men. In such cases, some adjustments may be necessary to make the job accessible to women.[290] The potential for adjusting one's job parameters is important, not only for women, but also for some ethnic groups of smaller average size, and is essential for disabled people.[291] Such adjustments may be simple, such as changing the height of the work surface or the size of tools. A woman working at a non-adjustable task originally developed for the average man may feel as though she is using a metric tool on a car manufactured using the English measuring system: everything is a little bit wrong. Unless the task is adapted to the worker's size and shape, accidents, backache, shoulder and wrist problems and other aches and pains may result.

The need for adjustable work stations is not specific to women; all workers are more comfortable and efficient with well-designed tools and positions. For example, when a 147 cm tall woman began work at a Montreal clothing manufacturer, ergonomists were called in to examine

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288. S. Pheasant, *Bodyspace*, Taylor and Francis, London, England, 1986, Chapters 5 and 6.

289. L. Laubach, "Comparative muscular strength of men and women," *Aviation, Space and Environmental Medicine*, 47, 1976, pp. 534-542.

290. I. Matsdorf, "Women at work in workplaces designed for men: anthropometry and ergonomics." *Work and Stress* 1, 1987, pp. 293-297.

291. J. Ridington, *Different Therefore Unequal: Employment and Women with Disabilities*, DisAbled Women's Network Canada, Vancouver, B.C., 1989, p. 17.

her work station. Among other adjustments, they installed a platform to enable her to reach the work surface. Her co-worker, a 188 cm tall man who had backache from bending over this work surface all day, asked the ergonomists to help him too!

Most protective equipment in the "non-traditional" workplace was developed for the average white man. It is therefore too large for most women and for members of many ethnic groups. Even laboratory workers in the health sciences, most of them women, have trouble finding protective gloves small enough. There is a risk of accidents due to wearing the wrong size protective equipment: masks that are too big for the face leak, exposing the worker to pollutants; gloves that are too big allow tools to slip; guards on saws and other dangerous equipment that are placed where they will protect large bodies do not protect small ones; badly fitting clothing is an encumbrance and a potential cause of accidents.[292]

There are no simple differences between men and women in lifting and manipulating weights; both sexes may suffer from musculo-skeletal problems of industrial origin.

Both women and men suffer from back pain as a result of their work. About 70 percent of hospital workers have chronic or intermittent back pain associated with lifting weights.[293, 294] Women's traditional jobs often involve lifting small weights at high frequency, while those done by men more often involve lifting heavy weights with rest periods. For example, male labourers in the plastics industry lift and carry one hundred 20 kg rolls of plastic wrap per day, for a total of 2,000 kg. When added to the weight of the other things they carry, their total load per day is 2,404 kg. However, sewing machine operators were observed lifting pants (1,800 pairs per day), for a total of 400 kg per day, and they

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292. J. Stellman, A.J. Rosenberg, B.M. Aufierno and M.S. Henefin, "Personal protective equipment for women: The state of the art," *Proceedings of the 1984 International Conference on Occupational Ergonomics*, Vol. 1, 1984, pp. 15-19.

293. *Supra*, Note 28.

294. A.-S. Ljungberg, A. Kilbom and G. Hag, "Occupational lifting by nursing aides and warehouse workers," *Ergonomics*, 32, 1989, pp. 59-78.

also pushed foot pedals for a total of 18,000 kg per day.[295] So it cannot be said that one sex or another is "more suited" to using physical strength. However, it is important to investigate whether the strength requirements of traditional men's jobs pose a risk for the average woman.

Detailed strength testing of women and men has been done involving tasks of the types usually done in industry by males.[296] These are

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295. N. Vézina and J. Courville, "Des postes traditionnellement féminins aux postes traditionnellement masculins." In *Un sexe trop faible ou un travail trop ardu: La recherche sur la santé des travailleuses*. Ed. C. Brabant, K. Messing. Cahiers de l'ACFAS, Association canadienne-française pour l'avancement des sciences, 1990.

296. F. Aghazadeh and S.R. Dharwadkar, "Effect of gender on physical work capacity and strength," *Trends in Ergonomics/Human Factors II*, R.E. Erberts and C.G. Erberts (ed.), Elsevier science publishers, Amsterdam, 1985, pp. 551-557.

P. Bishop, K. Cureton and M. Collins, "Sex differences in muscular strength in equally-trained women and men," *Ergonomics*, 30, 1987, pp. 675-687 (in press).

E.J. Celentano, J.W. Nottrodt and P.L. Saunders, "The relationship between size, strength and task demands," *Ergonomics*, 27, 1984, pp. 481-488.

T. Hoffman, R.W. Stauffer and A.S. Jacson, "Sex differences in strength," *Women in Sports*, 7, 1979, pp. 265-267.

W.W. Hosler and J.R. Morrow, "Arm and leg strength compared between young women and men after allowing for differences in body size and composition," *Ergonomics*, 25, 1982, pp. 309-313.

L.L. Laubach, "Comparative muscular strength of men and women," *Aviation, Space and Environmental Medicine*, 47, 1976. pp. 534-542.

C.J. Mackay and C.M. Bishop, "Occupational health of women at work: some human-factors considerations," *Ergonomics*, 27, 1984, pp. 489-497.

R.B.J. Macnab, P.R. Conger and P.S. Taylor, "Differences in maximal and submaximal work capacity in men and women," *Journal of Applied Physiology*, 27, 1969, pp. 644-648.

S.T. Pheasant, "Sex differences in strength, some observations on their variability," *Applied Ergonomics*, 14, 1983, pp.205-211.

J.S. Ward, "Women at work - ergonomic considerations," *Ergonomics*, 27(s), 1984, pp. 475-476.

J.D. Watkeys, "Women in the work environment," *Journal of Occupational Medicine*, Vol. 17, 1975, pp. 308-312.

J.H. Wilmore, "Alterations in strength, body composition and anthropometric measurements consequent to a 10-week weight training program," *Medicine and Science in Sports*, 6, 1974, pp. 133-138.

laboratory simulations, which may or may not be applicable to the types of situations which arise in real factories. In real situations, for example, a woman can adapt the task to her body and to her way of doing things, while in the laboratory her task is fixed. On this type of test, women's strength averages around two-thirds of men's.

However, the degree of difference depends on details of the task, and there is a great deal of overlap between men's and women's performances. When performance is measured on tasks involving displacing weights in the style associated with men's jobs, that is, a large weight is lifted all at once with opportunities for rest, the male/female difference is greatest for ... ling weights and least for pushing and pulling weights.[297] ...formances in handling weights with the upper body differ more than ... with the lower body.[298] Also, male/female differences in lifting tasks disappear to some extent with athletic training[299] and with industrial experience.[300]

In the real world the techniques for lifting must be taken into account. Women who lift weights often devise ways to take advantage of their strengths. An analysis of work accidents in Quebec showed that women and men use different techniques to handle weights.[301] Small changes in the task can minimize sex differences; for example, the average woman can push a horizontal pedal 91 percent as hard as a man when the pedal position is favourable, and only 50 percent as hard when it is unfavourable.[302]

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297. S.H. Snook and V.M. Ciriello, "Maximum weights and work acceptable to women workers," *Journal of Occupational Medicine*, 16, 1974, pp. 527-534.

298. J.E. Falkel, M.N. Sawka, L. Levine and K.B. Pandolf, "Upper to lower body muscular strength and endurance ratios for women and men," *Ergonomics*, 28, 1985, pp. 1661-1670.

J.E. Falkel, M.N. Sawka, L. Levine et al., "Upper body exercise performance: comparison between women and men," *Ergonomics*, 29, 1986, pp. 145-154.

299. P. Bishop, K. Cureton and M. Collins, "Sex difference in muscular strength in equally-trained men and women," *Ergonomics*, 30, 1987, pp. 675-687.

300. *Supra*, Note 297.

301. M. Lortie, "Analyse comparative des accidents déclarés pas des préposés hommes et femmes d'un hôpital gériatique," *Journal of Occupational Accidents*, 9:, 1987, pp. 59-81.

302. E.N. Corlett and R.P. Bishop, "Foot pedal forces for seated operators," *Ergonomics*, 18, 1975, pp. 687-692.

Accidents and injuries are most common when workers first take a job, while they are adjusting the tasks to their capabilities. The first woman who takes a particular job is at special risk, since she has no experienced co-workers who have adapted the job to her type of body. The problems may be compounded by poorly fitting work clothing and equipment, originally designed for the average man.[303] For example, women's centre of gravity is lower than men's, so women's ability to carry heavy weights can be improved if the weights are slung from their hips.[304]

Do non-traditional jobs have specific risks, different from those of traditional jobs?

Non-traditional jobs generally have a higher accident rate

A U.S. survey has shown that men have twice as many disabling injuries at work as women. Serious accidents are much more frequent in construction, forestry, and foundries than in restaurants and offices. For example, press operators are exposed to the greatest risk of amputation of any American workers; however, men and women in this profession have an equal risk of accidents. Over the last 18 years, rates of industrial accidents have risen for both sexes, and women's rate is approaching men's.[305] Women who enter new occupations may be exposed to increased risk of accidents due to inexperience with machinery.

In addition to the increased risk of injury due to the nature of the occupation, women entering non-traditional occupations may be exposed to an increased risk of accidents if attention is not paid to appropriate equipment design. Farm workers may work with corn elevators which are not balanced to allow for safe operation by smaller

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303. J.M. Stellman, A.J. Rosenberg, B.M. Aufiero and M.S. Henefin, "Personal protective equipment for women." In Attwood, D.A., McCann, C., (eds), *International Conference on Occupational Ergonomics, Proceedings*, Volume 1, 1984, pp. 15-19.

304. T.M. Cook and D.A. Newman, "The effect of load placement on the EMG activity of the low back muscles during load carrying by men and women," *Ergonomics*, 30, 1987, pp. 413-423.

305. J. Robinson, "Trends in racial equality and inequality and exposure to work-related hazards, 1968-1986," *American Association of Occupational Health Nurses Journal* 37, 1989, pp. 56-63.

people.[306] In the United States, female telephone workers had more accidents climbing telephone poles than men did. The cause was identified; women's boots had been adapted without change from men's, but the difference in male and female hip joints made the women's boot approach the pylons at a dangerous angle. The boot heel shape was changed to make the job safer for women.[307]

Non-traditional jobs involve a different way of handling weights from traditional women's jobs

As mentioned above, industrial tasks done by women often involve lifting relatively light weights many times at a fast pace, while those done by men more often involve lifting heavy weights with rest periods. For example, the work cycle time required for the same movement to be repeated in a machine shop was 10 days, compared with six seconds for a sewing machine operator.[308] The worker in the machine shop lifts weights less than 1 percent of the time during his or her work day, compared with 25-35 percent of the time for the sewing machine operator. Nevertheless, the concentrated physical strength required by some jobs may be at the limit of most women's capacity. Without adequate training or adjustment of the task, women may risk musculo-skeletal problems. Adapting tasks to women could involve shaping tools and weights differently and arranging for loads to be supported at different points on the body. As some physically demanding jobs are currently designed, women and men who do them may in fact risk muscle and joint problems.

Newly desegregated worksites may lack amenities for women

In a newly desegregated workplace there are often no shower facilities for women, and therefore women may face greater exposure to pollutants. Women may also be at risk of health problems if a newly desegregated workplace does not provide toilet facilities for them or if, due to fear of harassment, women do not use available facilities.

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306. Saskatchewan Safety Council, *Farm Safety Manual*, Farm Safety Council, Regina, Saskatchewan, 1989, p. 4.

307. Dr. J. Stellman. Personal communication.

308. *Supra*, Note 295.

Table 4

Occupations Showing a Large Increase in Women Workers from 1971 to 1986, Canada

Occupations	Sex	1971	1986	% Increase[1] 1971-1986
All occupations	**F**	**2,961,210**	**5,466,515**	**85**
	M	**5,665,715**	**7,316,990**	**29**
Managerial, administrative and related	F	58,310	324,325	456
	M	313,930	684,670	118
[2]Accountants, auditors and other financial officers	F	15,655	74,595	376
	M	87,365	115,725	32
Social sciences	**F**	**29,530**	**139,050**	**371**
	M	**49,525**	**101,730**	**105**
[2]Occupations in welfare and community services	F	8,550	45,950	437
	M	9,285	16,590	79
Natural sciences, engineering and mathematics	**F**	**17,105**	**80,065**	**368**
	M	**217,025**	**370,255**	**71**
[2]Architectural and engineering technologists	F	570	5,205	813
	M	23,450	44,780	91
Artistic, literary, recreational & related occupations	**F**	**21,895**	**84,650**	**287**
	M	**58,585**	**115,310**	**97**
[2]Writers and editors	F	4,610	15,505	236
	M	10,170	18,365	80
Sales	**F**	**247,765**	**544,515**	**120**
	M	**567,980**	**722,880**	**27**
[2]Supervisors; sales occupations, commodities	F	41,975	96,755	131
	M	208,295	199,200	-4

Source: Statistics Canada, Census 1986. Occupational Trends, 1961-1986, *Dimensions*, Ottawa, November 1988, Catalogue No. 93-151.

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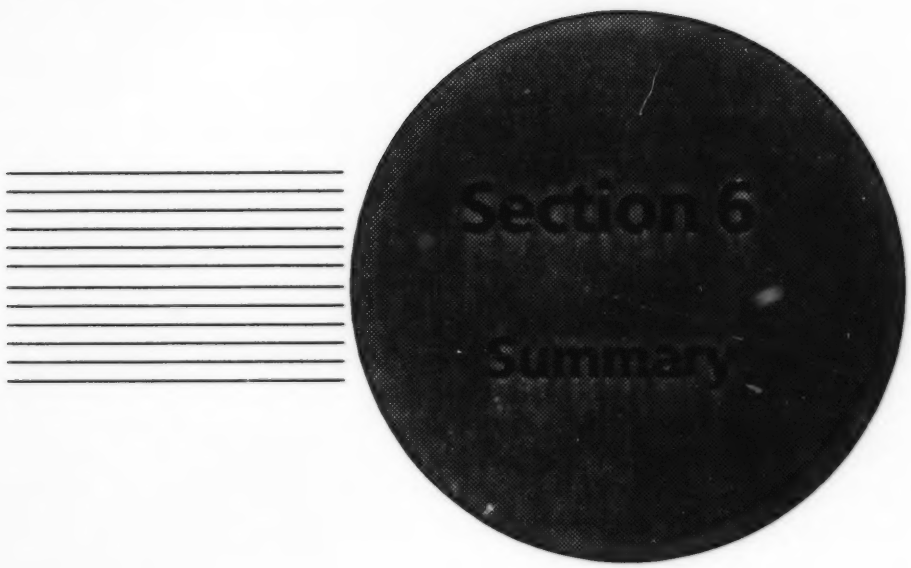
1 Calculated from Statistics Canada data.

2 These examples are the professions with the most women in the occupational group and which grew substantially during 1971-1986.


Section 6
Summary

While their participation in the labour force has been growing rapidly, women tend to dominate in certain occupations, which may have specific safety and health risks. Furthermore, there has been a dramatic increase in the labour force participation of women of childbearing age, who may be exposed to hazardous working conditions during pregnancy or lactation. Women are slowly moving into occupations traditionally held by men. All these factors have stimulated interest in occupational safety and health (OSH) concerns of women.

The discussion begins with the rationale for dealing specifically with *women's OSH* issues, followed by a general presentation of how to identify and measure health effects in a workplace. This includes an examination of how to link workplace physical, chemical, biological, ergonomic and psycho-social conditions with health effects, while taking into account differences in lifestyle and personal characteristics.

The text describes the tasks and types of work traditionally performed by women in many workplaces and concludes that risks associated with these characteristics (fast-paced work, repetitive work, static postures, and others) have been insufficiently documented. However, some evidence is presented linking these workplace stressors with health effects. The paper suggests that these conditions must be taken into account in order to ensure appropriate standard-setting in traditional women's jobs.

Risks associated with selected jobs occupied predominantly by women are also described. Several of these occupations, such as teaching, cleaning, restaurant and sales work, have not yet been the subject of extensive study, and examples are provided suggesting orientations for further research. Studies on women agricultural workers have been impeded by difficulties in identifying these workers with existing statistical tools. The paper also points out the need to identify those occupational exposures which may lead to difficulties associated with fertility, sexuality, lactation and menstruation and gaps in our knowledge of ergonomic effects on the health of pregnant workers.

The paper contends that several stressors may combine to affect women's health. Household and family responsibilities, low income and, in some cases, discrimination may combine with workplace hazards to place particularly heavy burdens on women's physical and mental health. If employees happen to be disabled, unable to communicate in the language of the workplace, or subject to harassment due to disability

or race, they may be especially likely to suffer the ill effects of workplace conditions. Over a worker's lifetime, health may be gradually eroded, resulting in problems for aging workers.

The paper suggests that there are methodological challenges involved in research on the effects of women's working conditions. Attention should be paid to conceptualization and development of research techniques which would facilitate understanding of the effects of working conditions on women's health. For example, research on the use of biological indicators and of symptoms rather than pathologies as indicators of health status would shorten the time needed to identify health hazards. Global indicators of health problems, such as medical visits, may be used to complement searches for specific health problems associated with working conditions. Also, concept definition and scientific examination of situations resulting in perceived stress, using biological indicators of the stressed state, are emerging as useful tools for linking working conditions to short-term and long-term health effects. The paper also suggests that attention be paid to accurate measurement of exposures and that tools be developed to allow consideration of the interacting effects of workplace conditions.

Another area for further research suggested by the paper is the design of tasks, equipment and work stations, especially in traditionally male-dominated, blue-collar or industrial jobs, for people whose body size, weight distribution, and type of strength differ from those of the average male. Attention is drawn to the fact that knowledge of the range and diversity of human physiology and work practices should have a greater influence on work station and equipment design. Research into rendering tasks adjustable to different body types could permit wider access to trades and blue-collar jobs for both women and men.

While a great deal is known about women's workplace health and safety concerns, still more research needs to be undertaken to identify these concerns more fully and to address them effectively.[309]

It is concluded that all workers will benefit from knowledge which is used to diminish adverse health effects of workplace conditions.

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309. A summary of suggestions for areas in which research might be undertaken is outlined in K. Messing, "Are women the weaker sex or do they just have hard jobs? The need for research on women's occupational health," *Chronic Diseases in Canada*, March 1990, 11, pp. 25-27.